PRICE 50 CENTS

American Machinist

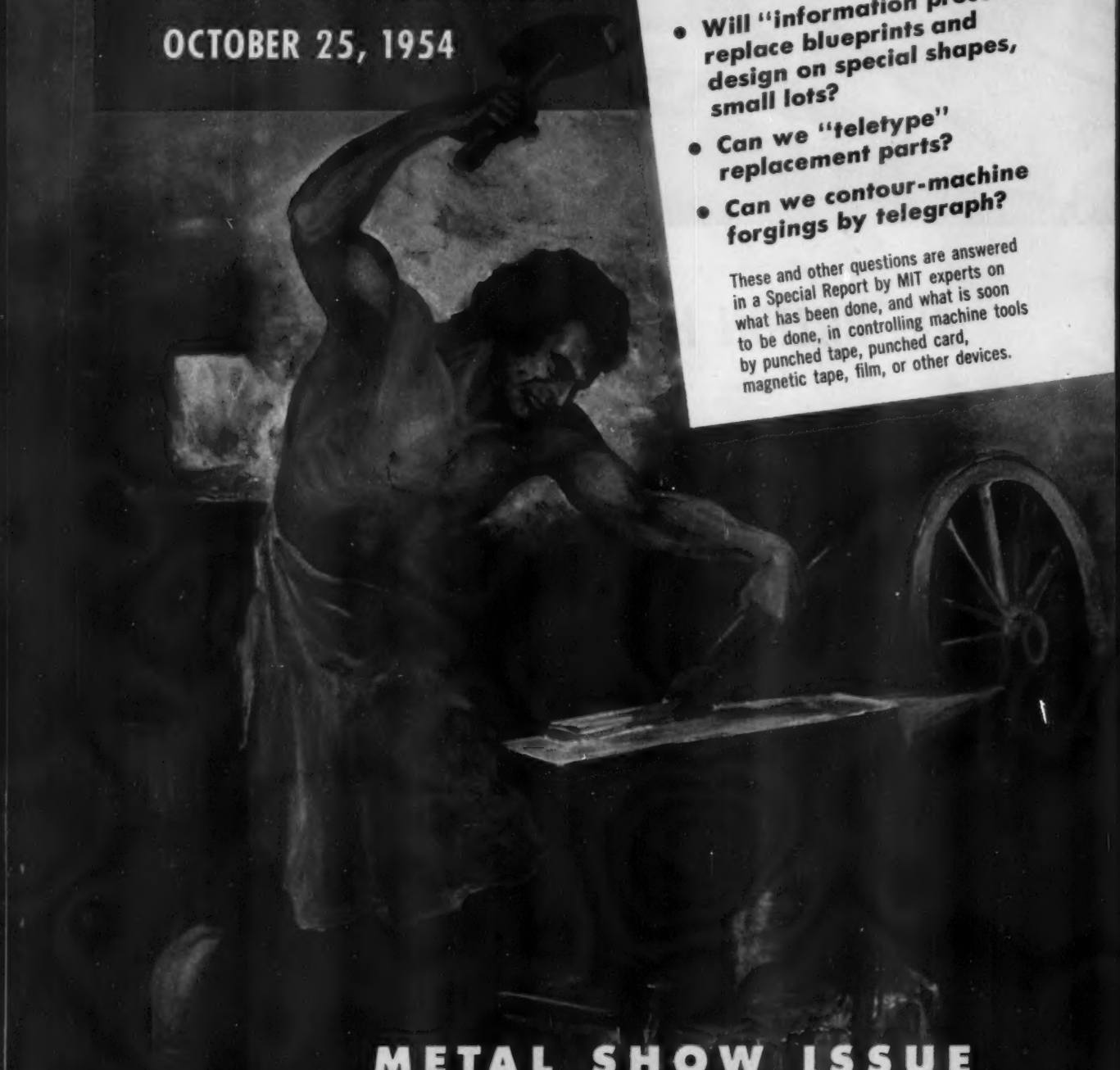
McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION

OCTOBER 25, 1954

NUMERICAL CONTROL OF MACHINE TOOLS

- **Are we entering the era of machine tools that "think electronically"?**
- **Will "information processing" replace blueprints and design on special shapes, small lots?**
- **Can we "teletype" replacement parts?**
- **Can we contour-machine forgings by telegraph?**

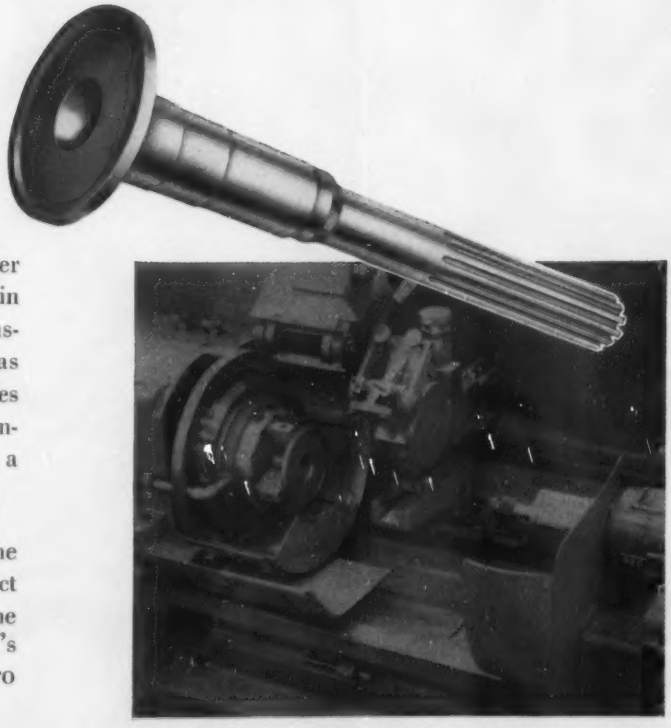
These and other questions are answered in a Special Report by MIT experts on what has been done, and what is soon to be done, in controlling machine tools by punched tape, punched card, magnetic tape, film, or other devices.



METAL SHOW ISSUE

5½ BILLION HORSEPOWER ON THE GO!

. . . your share is a little more dependable, more responsive, because of Heald precision-finished parts like this



Yours is among the more than 45 million passenger cars representing some 5½ billion horsepower in use today—a real tribute to the automotive industry and the precision mass production that has made it possible. There are many Heald machines in this production picture, precision finishing hundreds of different parts. The one shown here is a typical example.

Applied to any job, Heald precision means time and money saved—a finer, longer-lasting product that can stay ahead in the competitive race. That's why IT PAYS TO COME TO HEALD.

THE HEALD MACHINE COMPANY

WORCESTER 6, MASSACHUSETTS

Chicago • Cleveland • Dayton • Detroit • Indianapolis • New York

The model 271 Size-Matic Internal above precision grinds two different I.D.'s simultaneously in automatic transmission output shafts. Wheelhead spindle carries two wheels of different diameters. Air-operated diaphragm chuck simplifies loading. Entire operating cycle—rough grind, dress, finish grind, size and retract—is fully automatic. Constant feed throttling maintains consistent feed rates regardless of internal or external temperature changes.

American Machinist

MAGAZINE OF METALWORKING PRODUCTION

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ABC ABP

chips

HAND VS MACHINE . . . Our current cover is a study in contrasts: the blacksmith hand-forging in traditional fashion, while we announce a Special Report on numerical control for machine tools. More on the latter later—the blacksmith is from a section of a mural at Jones & Lamson Machine Co, Springfield, Vt, and was painted by Bernard F Chapman during off hours while he was an industrial designer there. You may recall a previous section of the mural, showing a toolmaker and his cat, published Mar 11, '48. And the blacksmith also reminds, as the original worker of metal, of the forthcoming Metal Show in Chicago, Nov 1 to 5.

TAPE, CARD, OR FILM? . . . For the past year, we have been hounding several scientists at MIT to give you an evaluation of tape, punch card, and film control of machine tools, based on four years of experience with the milling machine there. At last it is here for you, even though we had to send two editors up there to pin those busy men down. It's an evaluation of achievements to date and a forward view, complete with case studies that will surprise you. Don't miss our current 24-page Special Report. It's very significant.

METAL SHOW . . . As usual, we bring you items of new equipment to be shown for the first time at the Metal Show, to serve as a preview if you're going and a record if you can't make it. Also, a considerable part of our current issue is devoted to subjects to be stressed at meetings there—presswork, heat-treating, materials, welding.

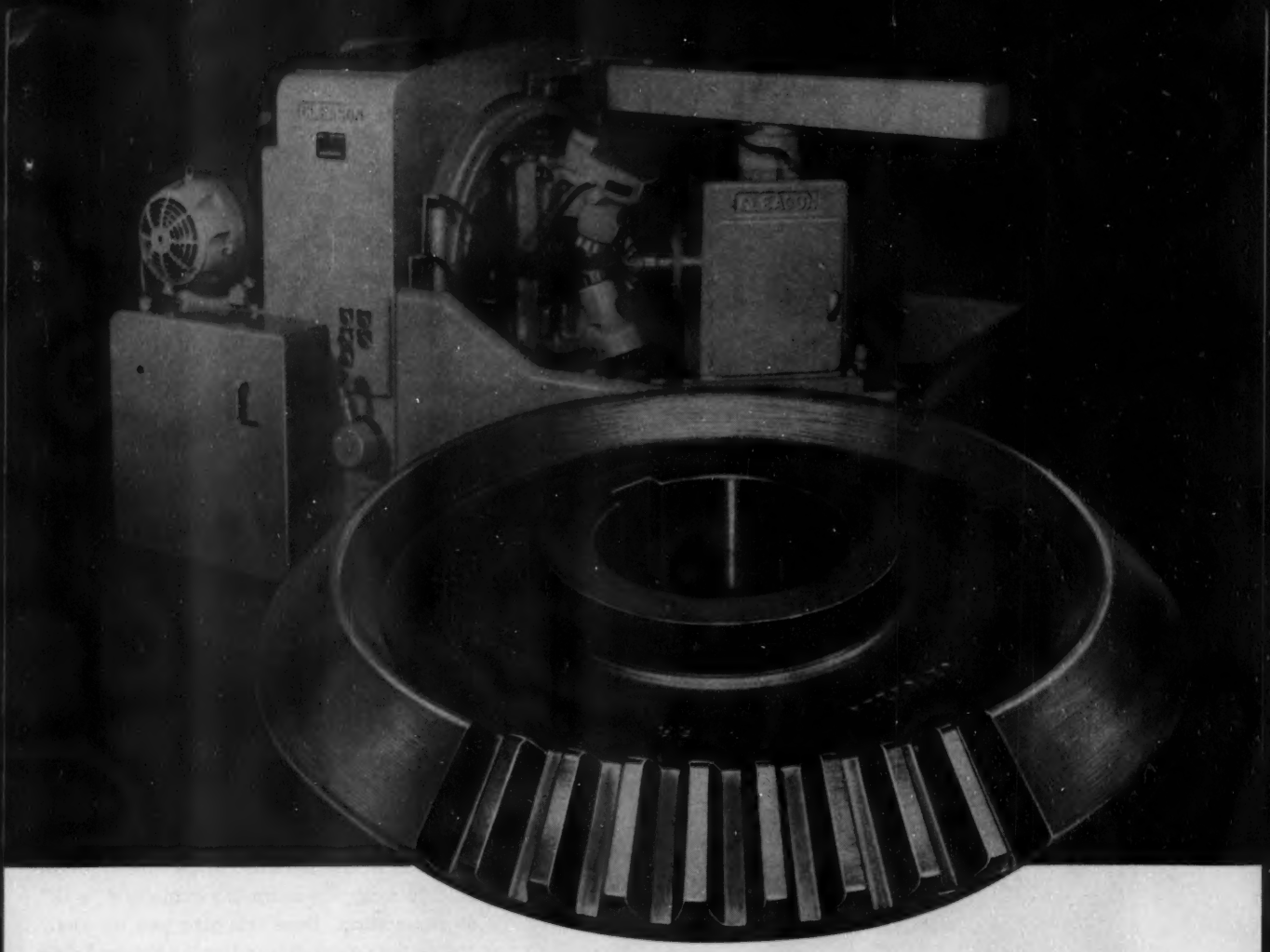
INDUCTION . . . For several years, New Britain Machine Co has been induction heat-treating gears with a special indexing fixture that does unusual, but necessary things. Designer Charles Pethybridge tells you how it works—and what it does—in our lead article.

SHELL MOLDING . . . We have contented ourselves thus far with evaluating the effects of shell molding on subsequent processes in Metalworking. But Frank Shallenberger of Shalco Engrg Co has prepared such a good evaluation of job-lot shell molding that we felt you should have it. It case-studies 23 low-production parts shell-molded as a test of economy.

TOOLING . . . Three articles give current tooling data. One is from Bendix Aviation, shows three revisions in method and four different machine setups that saved real money in contouring a generator shaft. . . . Another shows how a casting change cut machining costs. . . . The third is a group of Shop Shots of unusual jobs.

COMING . . . Nov 8 *AM* will be a bit unusual. It will include a major Special Report—48 pages—evaluating automation in Detroit with pictured case studies from half a dozen plants. Half the examples are from the new Pontiac setups, where automated special machines are the order of the day; others are from Buick, Packard, Chrysler, AC Spark Plug, and Saginaw Steering Gear.

C-Press Man . . . Ralph H Behrend has been in charge of C-press standarization and development at Hydraulic Press Mfg Co, Mt Gilead, Ohio, for the past year, is manager of the C-Press Division and an authority on press applications and production methods. With an engineering degree from Penn College, Cleveland, he has 36 years of experience in tooling. He went from apprentice to chief tool designer at Cleveland Automatic Machine Co, starting in 1918, has since been with Ohio Forge & Machine ('28-'30), Chicago Pneumatic Tool ('30-'32), GE ('32-'36), National Acme ('36-'42), Black & Decker ('42-'46), and Denison Engrg ('46-'53). His evaluation of C-frame presses is in this issue.



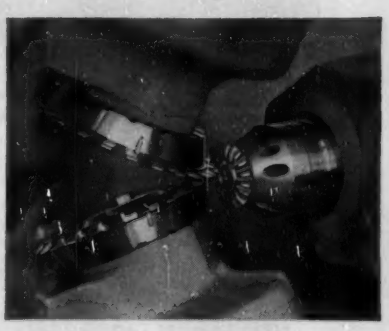
A complete gear for a fifth of a gear!

It all depends on the gear, of course. But, by the time an earlier model generator has cut one-fifth of a gear, the new No. 104 Straight Bevel Coniflex* Generator has *completed* a similar gear!

You can increase your production by as much as 500% with this new Gleason machine. You can get these results because this generator has two interlocking disc-type cutters with twenty-four blades each. These cutters complete a gear in *one rapid operation!*

But that is not all. The No. 104 is easy to set up—it has a wide range of capacity—it is excellent for small quantities or volume production. And, a new generating method insures high efficiency, fine finish, and maximum cutter life.

Write us and we will be pleased to send you a bulletin and further information on the new No. 104 Straight Bevel Coniflex Generator.



The No. 104 Straight Bevel Coniflex Generator completes gears up to 8½" diameter and 1⅜" face width, and from 20 to 3 DP.

*Coniflex® straight bevel gears with localized tooth bearing.

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Builders of bevel gear machinery for over 85 years

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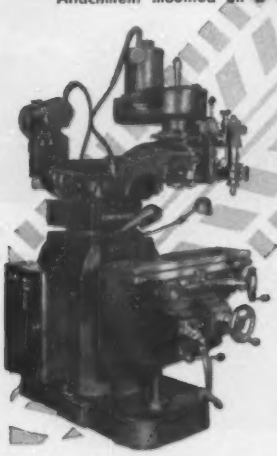
Ideas are where you

. . . and you may find a good idea in this rubber mold setup

Meticulous, demanding die sinking operations are transformed to automatic, carefree operations with the Power Driven Duplex Rotary Table Attachment mounted on a CINCINNATI 8" x 18" Tool and Die Miller.



CINCINNATI 8" x 18" Tool and Die Milling Machine. Brief specs. in Sweet's Machine Tool Catalog. Complete information in catalog No. M-1731.

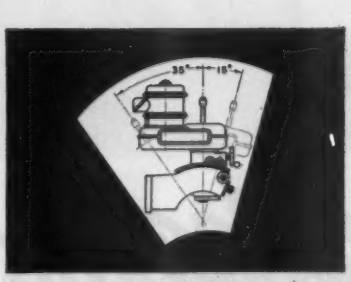
Notice how the cutter spindle and tracing head of the CINCINNATI 8" x 18" Tool and Die Miller at the right are swiveled to the most advantageous tracing and cutting position. The head can be swiveled right and left, forward and back, around a pivot approximately at the end of the cutter. Does this give you an idea? Notice the extra large cutting range evident from this setup; it's actually 8" x 18" in one setting. Does this give you an idea? Notice the power driven Duplex Rotary Table Attachment; it rotates the master and work (mold) at the same speed under the cutter and tracing finger. Does this give you an idea? There are many exclusive advantages of the CINCINNATI 8" x 18" Tool and Die Miller that you can translate into useful and profitable ideas for producing dies and molds, and for toolroom milling. Brief data on these machines will be found in Sweet's Machine Tool Catalog; complete information may be obtained by writing for catalog No. M-1731.

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO

CINCINNATI

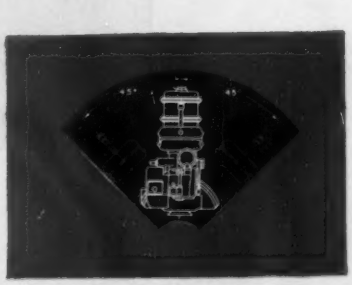
find them

Milling the tread in a tire mold. The machine is a CINCINNATI 8" x 18" Tool and Die Miller, equipped with a power driven Duplex Rotary Table Attachment.



Transverse swivel range of spindle

Longitudinal swivel range of spindle



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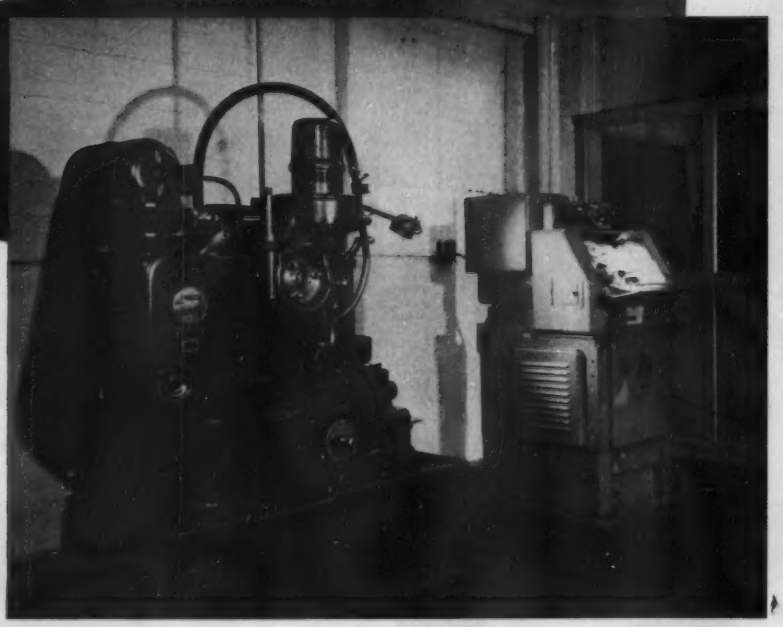

THE *Fellows*

. . . *basic* for GEAR TRAINS in ELECTRONIC INSTRUMENTS

Runout tolerances to 'two tenths' are an everyday requirement in a train of gears so perfect that they spin freely at the lightest finger touch.

This unit, with gears from a production lineup of Fellows Gear Shaper, Shaving Machine and "Red Liner" at the Electronic Instrument Division of Ketay Manufacturing Company, New York, is evidence of the results of quality-control at its best.

In spite of the greater accuracy demanded for these sensitive electro-mechanical devices, gear production costs are still of vital importance. The ability of Fellows machines and tools to hold costs under control and to work within the most critical tolerances is being proved every day on the production lines of many industries.

If you have gears to cut, you owe yourself a close look at the cost-control potentials of Fellows equipment. The nearest Fellows Office will be glad of an opportunity to send literature or offer personal counsel.

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Head Office and Export Department: 78 River Street, Springfield, Vermont.
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2206 Empire State Building, New York 1

. . . FOR

CLOSE-TOLERANCE GRINDING

of SMALL PARTS at

HIGH PRODUCTION RATES

THAT CUT COSTS,

Don't wait . . . for extra profits install a Van Norman machine now! They are available on four purchase plans — Outright sale . . . Purchase on conditional sales contract up to 5 years . . . Straight lease . . . Lease with option to buy. See your dealer or write Van Norman Company.

Lease and Conditional Sales Contracts not available to Export

VAN NORMAN

MANUFACTURERS of—Ram and Column Type Milling Machines, Cylindrical Grinders, Spline and Gear Grinders, Oscillating Radius Grinders, Special Production Grinders, Centerless Grinders.

This outstanding centerless grinder can help you cut your grinding costs. It provides fine finish to close tolerances at high production rates. Actually three machines in one, the Diversimatic is a standard centerless grinder for throughfeed work . . . a standard centerless grinder for infeed jobs . . . and equipped with the Crush Forming Attachment, it does form grinding not possible by any other method.

The Diversimatic finish grinds small parts from solid . . . or finish grinds rough-turned parts. It grinds faster, holds tolerances, cuts costs.

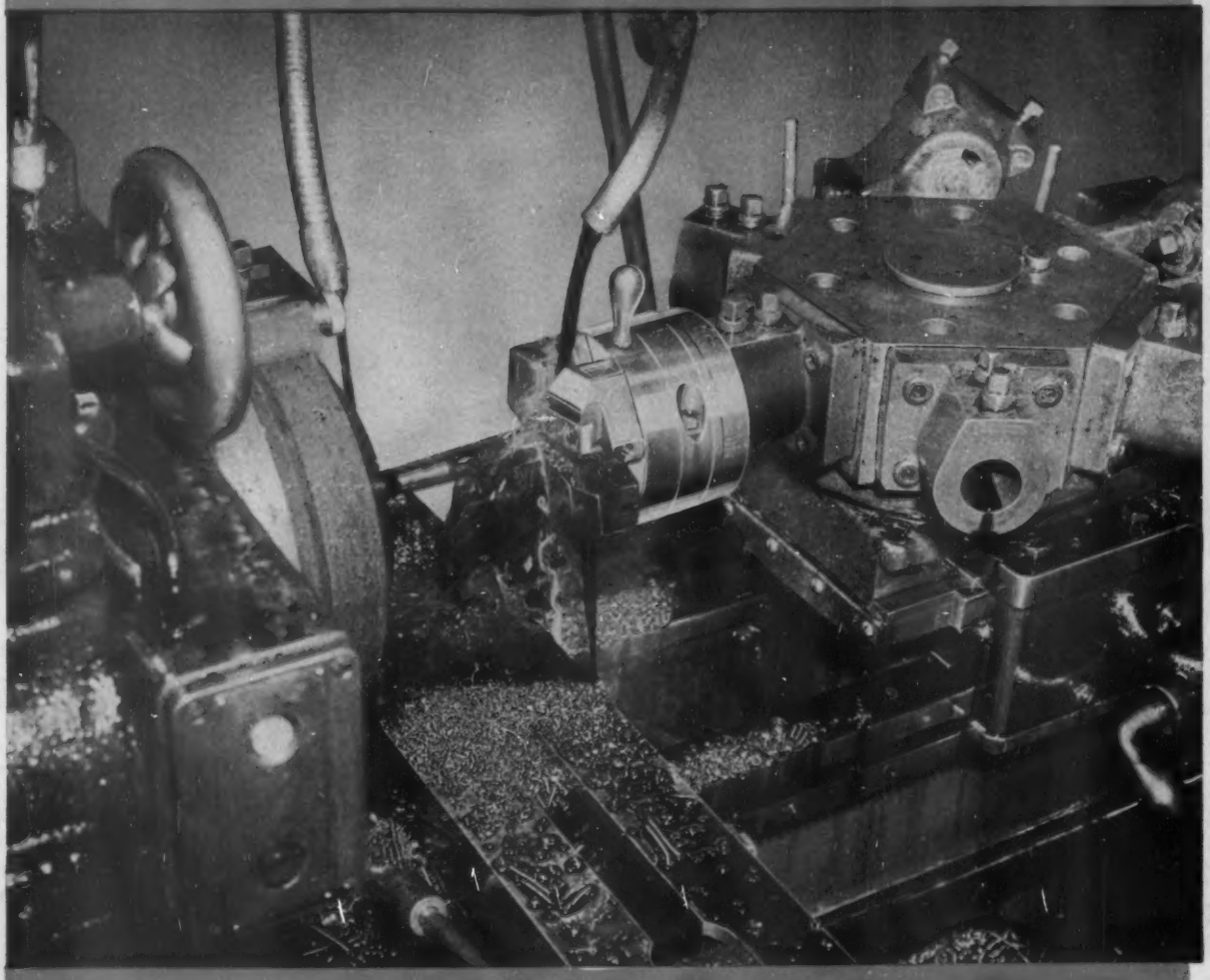
CENTERLESS GRIND PARTS LIKE THESE FASTER, MORE ECONOMICALLY ON THE DIVERSIMATIC

Get the full facts on the Van Norman Diversimatic Centerless Grinder. See for yourself how this versatile grinder can cut your grinding costs on small shafts, formed shapes, parts of two or more diameters or special contours.

COMPANY | **SPRINGFIELD 7, MASSACHUSETTS**

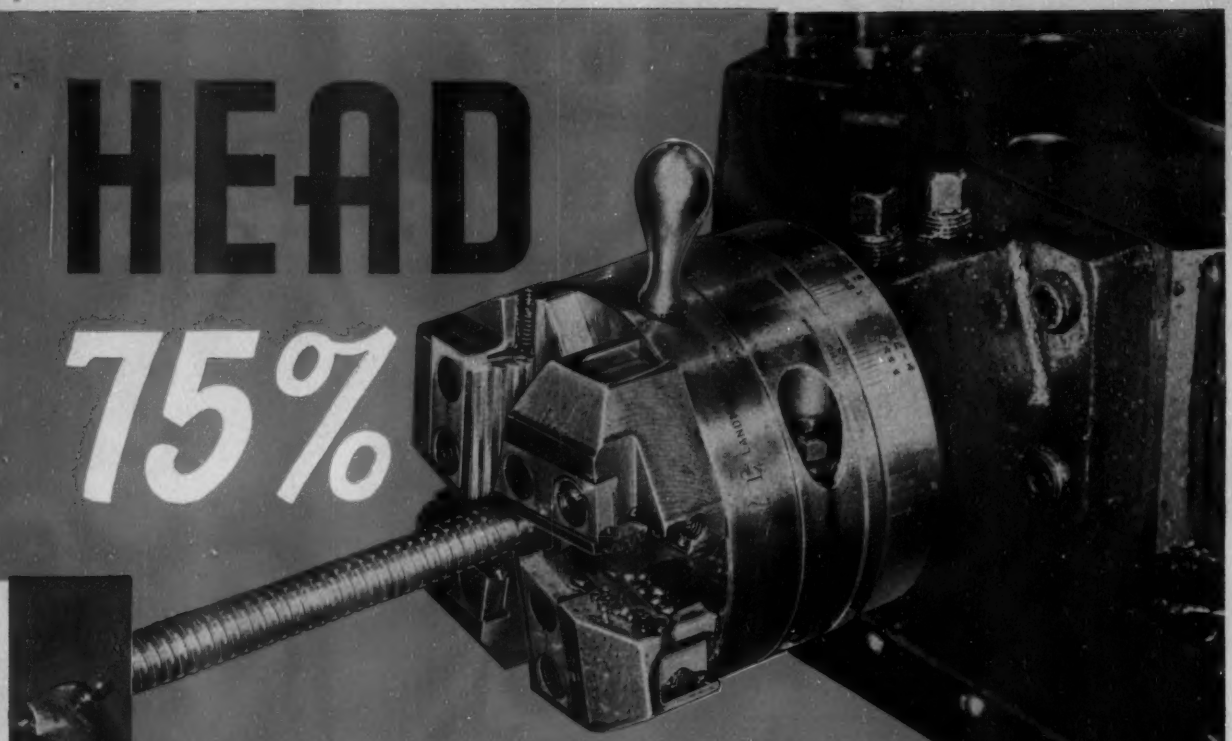
LANDMATIC

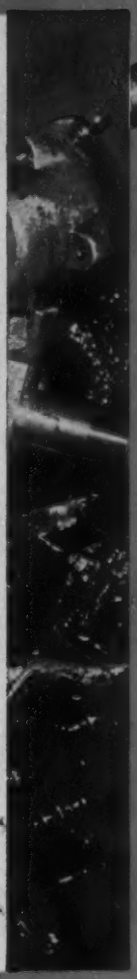
Reduces Cost by



• • • • • THE WORLD'S LARGEST EXCLUSIVE

HEAD 75%





Large savings on threading operations have been realized through the use of LANDMATIC Heads by Scott Aviation Corporation, an aircraft equipment manufacturer. These savings are made possible by great reductions in machining time and by quicker product assembly resulting from improved thread quality.

In producing Stabilizer Screws for a light aircraft manufacturer, a 5/8-6 Acme thread must be cut to a length of 5 3/8" on cold-drawn stock. Spec. #A1S1, B1112. This thread must be held to the close tolerance of ±.001 between the P.D. of the thread and the O.D. of the screw, for the full thread length.

Former threading methods required two passes to produce the finished thread to the required tolerances—one roughing and one finishing cut. Even then, hand fitting with the mating nut was necessary during assembly.

These operations are now performed on a turret lathe equipped with a 1 1/4" LANDMATIC Head and a Lead Screw Attachment. The required thread is cut in one pass in .192 minutes using a spindle speed of 230 RPM. Recent correspondence shows that approximately 3,500 pieces are completed between regrinding of the chasers. The general manager states that "We are quite proud of the fact that this job has worked out as well as it has and it is still running very efficiently."

LANDMATIC Heads are stationary self-opening threading heads designed for use on turret lathes. Their unusually-large oversize capacity allows them to handle a wide variety of threading operations. For further information and specifications, write for illustrated Bulletins F-80 and F-90.

LANDIS Machine COMPANY

WAYNESBORO • PENNSYLVANIA • U. S. A.

MANUFACTURERS OF THREAD GENERATING EQUIPMENT

Landis Announces

A New Centerless

Model 12½ — For work up to 6" diameter

NEW **Engineering Features**

NEW **Convenience Features**

NEW **Maintenance Features**

LANDIS

precision grinders

LANDIS TOOL COMPANY WAYNESBORO, PENNA., U. S. A.

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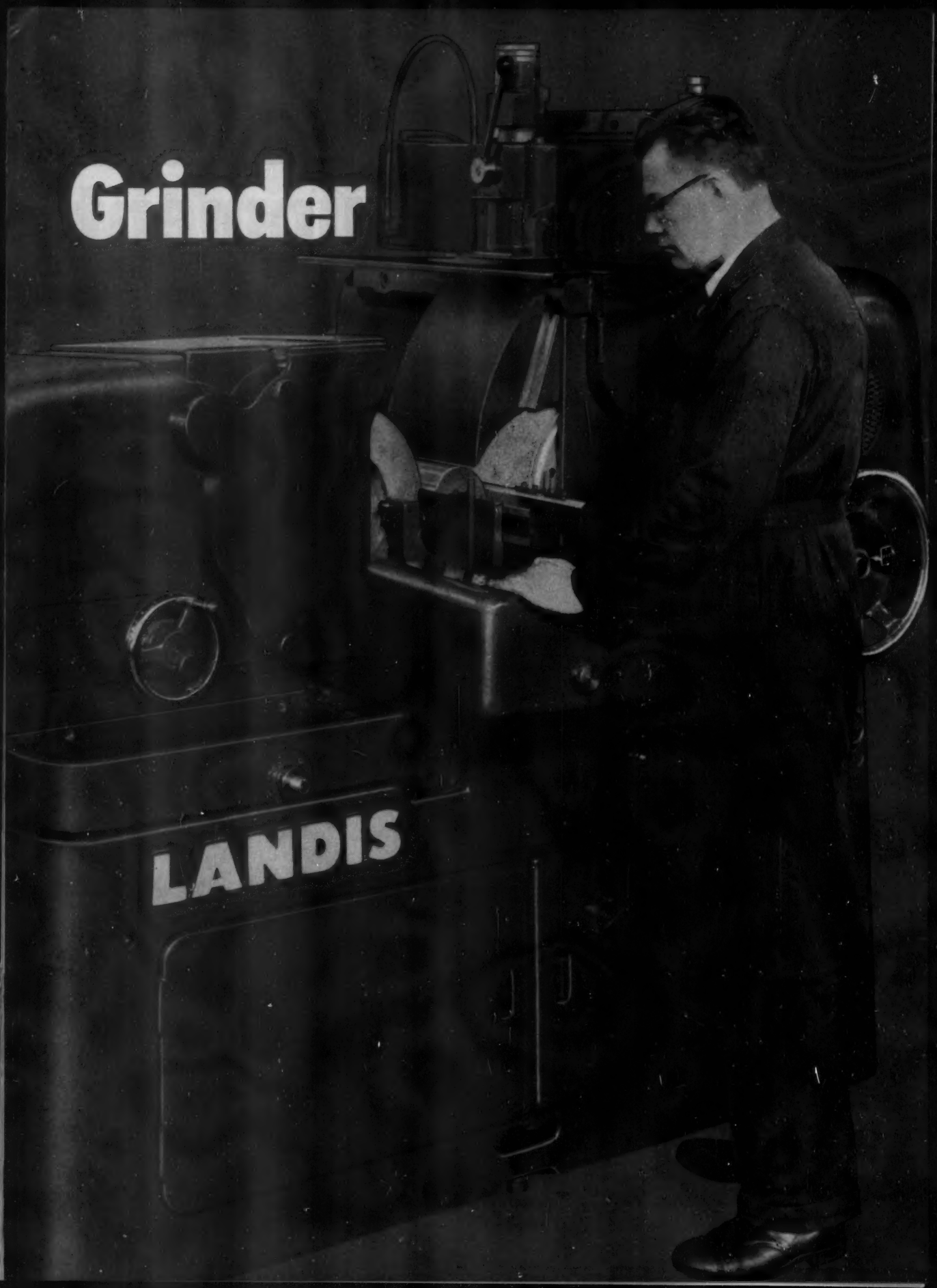

Grinder
LANDIS

You get 45 distinct standard equipment

Here's a highly skilled G&L craftsman making final adjustments in the spindle feed gears. All gears have been flame-hardened and precision ground to insure lasting precision... smooth, vibrationless positive power.

spindle speeds as with a G&L 30 Series

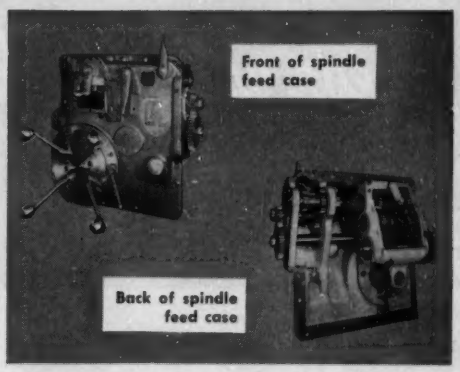
Only a G & L 30 Series table type Horizontal offers so many separate spindle speeds and positive all-geared spindle drive — plus the high torque and full power you need for efficient machining at low or high speeds.

THE engineering of a G&L 30 Series Horizontal Boring, Drilling and Milling Machine's headstock and spindle drive provides a perfectly balanced combination of versatility, efficiency and long-lived precision. With positive all-geared drive — 45 speeds in fine increments — are easy to select or change. Design of the gear train insures high torque at the cutter when working at lower speeds. And — at high speeds — the drive gear shifts and performs with a flywheel effect that provides maximum cutting efficiency of carbide tools. What's more, four gibs on the headstock assure maximum bearing surface, perfect alignment at all times.

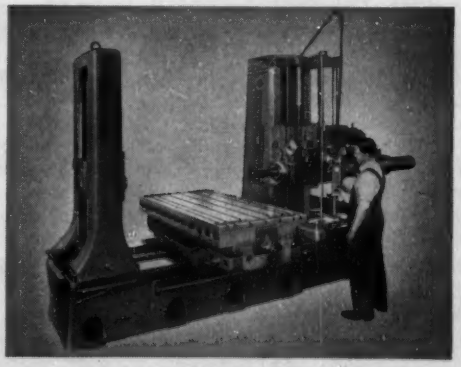
Check these other important advantages

Two of the many other additional advantages you get with a G&L 30 Series are (1) flame hardened and precision-ground bed and saddle ways which are standard equipment and, (2) the option of extended saddle, saddle supports and auxiliary runways which take the risk out of precision machining large workpieces that require the full range of the machine.

Comparing a G&L 30 Series with any other machine in its class — you'll discover that feature for feature, advantage for advantage, you can't buy better. Like all G&L machine tools, the 30 Series has been "often copied, never equaled."



Adjustable micrometer dial graduated in .001" provides fast, accurate spindle positioning. At right, dials beneath cover plate are geared to rotary selectors, show speed or feed engaged. While making selections, operator merely watches window until desired setting appears.



There are two basic models in the 30 Series — the 340-T with 4" spindle and 20 hp, or the 350-T with 5" spindle and 25 hp. Both machines offer a choice of three basic arrangements of table and saddle.

GIDDINGS & LEWIS MACHINE TOOL CO.

FOND DU LAC, WISCONSIN

Builders of the world's finest heavy-duty machine tools — Horizontal Boring, Drilling and Milling Machines — table, floor and planer types; Hypro Double Housing and Openside Planers; Planer Type Milling Machines and Vertical Boring Mills; and Davis Cutting Tools

PRATT & WHITNEY

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A MODERN CONCEPT IN SERVICE GEARED TO TODAY'S COMPLEX INDUSTRIAL NEEDS

Including . . .

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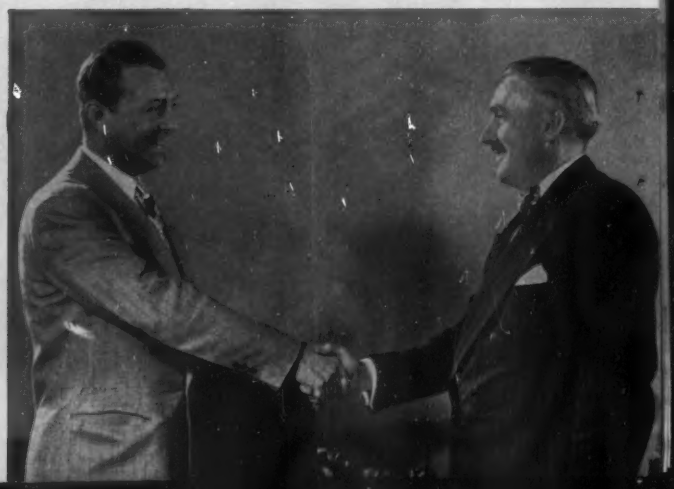
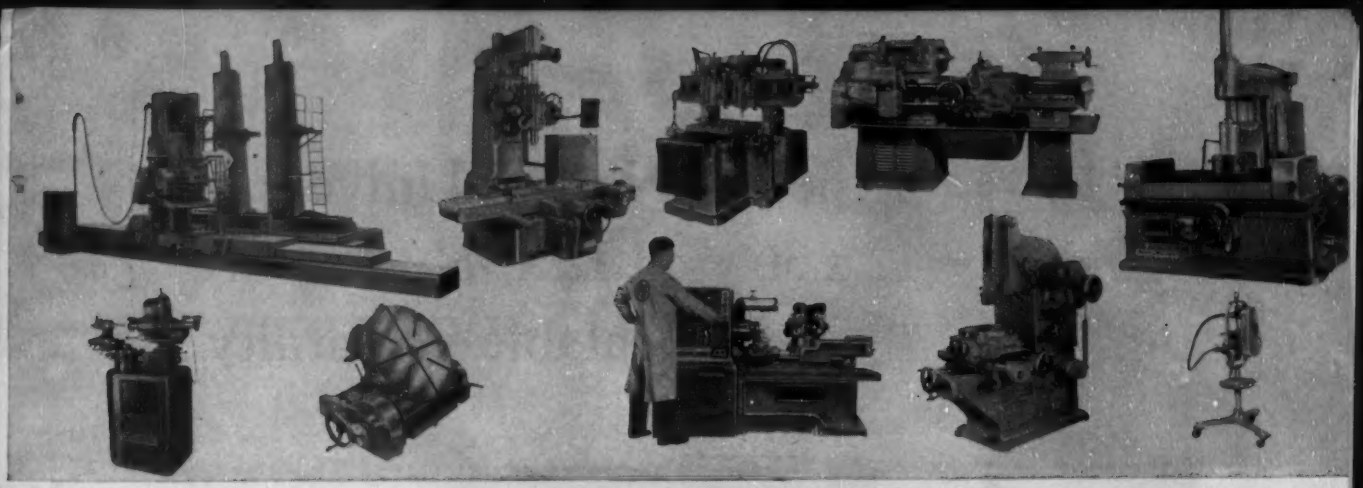
Pratt & Whitney Branch Offices are strategically located in principal manufacturing areas throughout the country; there's one conveniently near you . . . if not right in your own city, it's at least as near as the phone on your desk and within quick shipping distance. The P & W Branch Office in your area makes it a point to become familiar with your needs and to carry comprehensive stocks of the Pratt & Whitney Cutting Tools and Gages you call for. You are saved time, expense and trouble of maintaining large inventories in your stock rooms. Where desired, deliveries can be geared to your production schedules.

Expert Engineering Assistance

The Pratt & Whitney Representative who calls on you is a factory-trained specialist fully experienced in everyday manufacturing problems. Here is a man who talks your language. In direct contact with the Pratt & Whitney Plant, he places a wealth of practical engineering information at your disposal. This P & W Specialist is thoroughly qualified to recommend the right equipment exactly suited to your specific needs from the complete P & W lines of Machine Tools, Cutting Tools and Gages. Why settle for less, when straight-line, factory-direct skill and knowledge is yours for the asking?





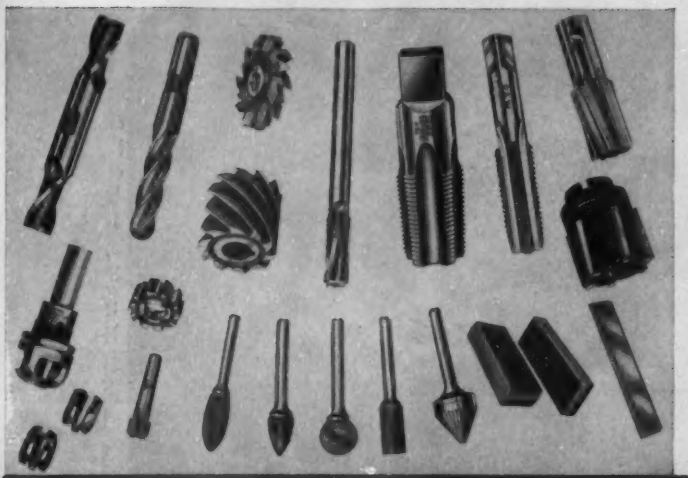
MACHINE TOOLS

Unique Combined Experience

MODERNIZE with PRATT & WHITNEY REPLACE FOR PROFIT

Manufacturing a complete line of Machine Tools, Cutting Tools and Gages, Pratt & Whitney possesses a unique combined experience and an unmatched ability to correlate all the varied and vitally interrelated problems of modern manufacturing. This position of superiority is manifested in the significant advances and improvements in Pratt & Whitney products . . . and in P & W's ability to serve you better *all ways!*

CUTTING TOOLS



GAGES

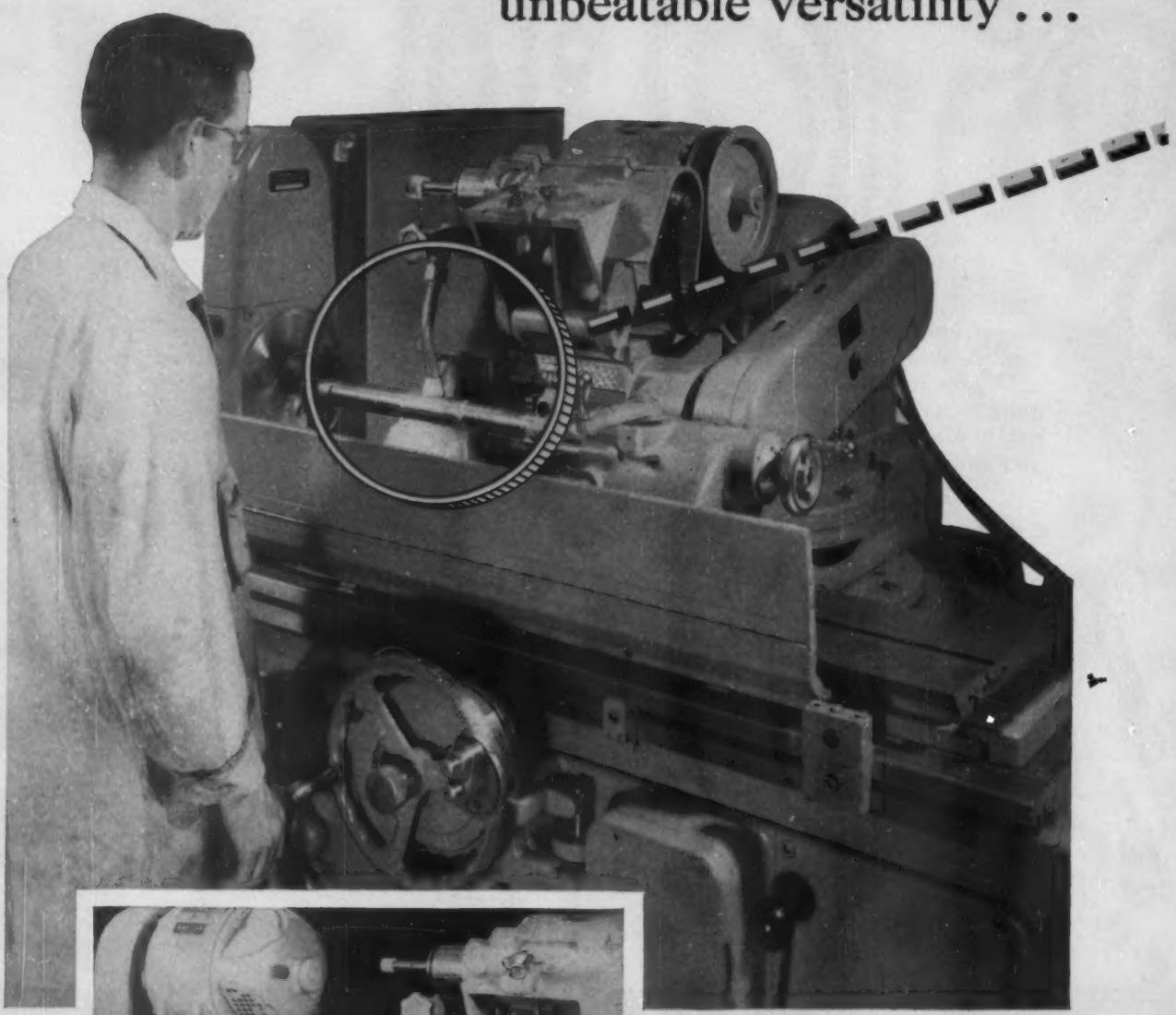
PRATT & WHITNEY
DIVISION NILES-BEMENT-POND COMPANY
WEST HARTFORD 1, CONNECTICUT, U. S. A.

BRANCH OFFICES AND STOCK . . . BIRMINGHAM* BOSTON • CHICAGO • CINCINNATI • CLEVELAND DALLAS (The Stanco Co.) • DETROIT • HOUSTON (The Stanco Co.) • LOS ANGELES • NEW YORK • PHILADELPHIA PITTSBURGH • ROCHESTER • SAN FRANCISCO ST. LOUIS • EXPORT DEPT., WEST HARTFORD
*Office only.

First Choice P&W *for Accuracy*

MACHINE TOOLS • CUTTING TOOLS • GAGES

NEW Type U4 Norton Universal Grinders — 12″x36″ and 12″x48″ — feature unbeatable versatility . . .



Quick, Easy Set-Ups plus fast grinding action enable this new Norton 12″ grinder to cut time and costs in a wide variety of external, internal, face and angular wheel feed grinding jobs. Here the internal grinding spindle is shown swung up and out of the way while a shaft is being ground.

Permanent Chuck Mounting is an outstanding advantage. Headstock spindle has a dog drive plate on one end. On the other is a 5″ D-1 cam lock nose, on which you can leave a chuck mounted permanently — merely swiveling headstock 180° to start chucking jobs faster.

do more jobs ... save more $$$

Greatly simplified set-ups give you more time for grinding

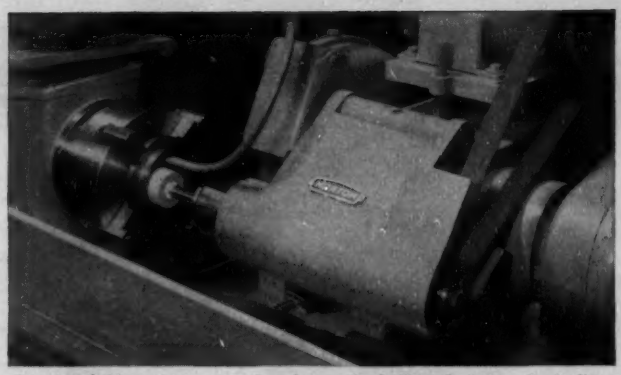
Double-barreled good news! The new Norton universal grinders are made in 12" x 36" and 12" x 48" work capacities!

Versatility keynotes the design, with feature after feature increasing the job range and cutting operating costs. For example, take the work speed range of 40 to 400 r.p.m. You get an infinite number of speeds over this wide range, simply by turning a dial.

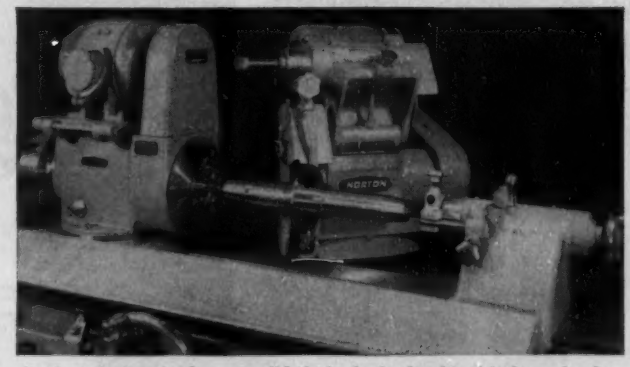
Other important features are illustrated here. It will pay you to look them over carefully — and consider their advantages in your own production.

Get the whole story

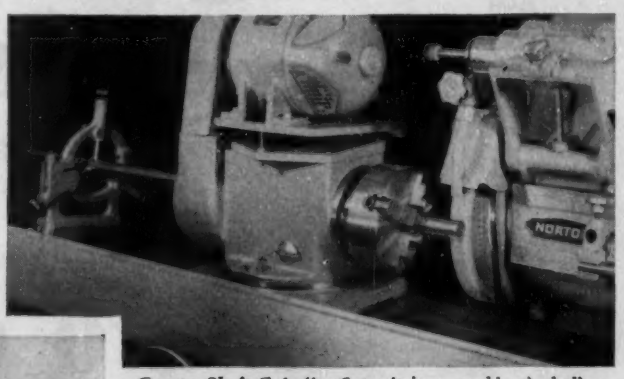
on the broad operational scope and fast, precision performance of these new Norton 12" grinders. See your Norton Representative, or write us direct. And remember: only Norton offers you such long experience in both grinding wheels and machines to help you produce more at lower cost. NORTON COMPANY, Machine Division, Worcester 6, Mass. *In Canada:* J. H. Ryder Machinery Co., Ltd., Toronto 5.



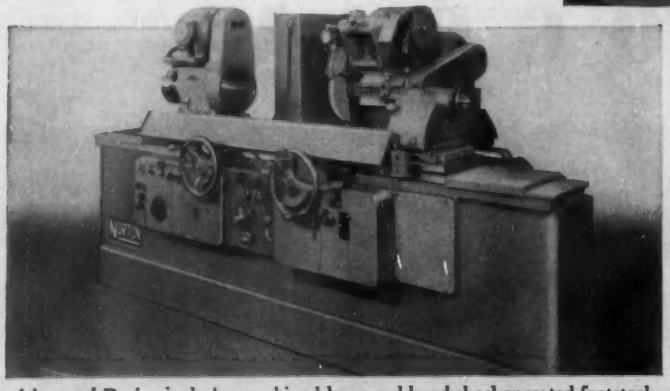
For Quick Change-Over to or from internal grinding, the internal grinding spindle is permanently hinged to front of wheel slide. This also enables you to perform both internal and external grinding on a single workpiece without changing the set-up.



Settings At Any Angle are possible for both wheel and feed, independently, with this compound wheel head slide. Wheel head has swivels above and below the slide ways; upper wheel head member can be positioned to extend capacity when wheel head is swiveled.



Greater Shaft-Grinding Capacity is assured by the hollow spindle in the headstock. A 1¼" hole clear through the headstock spindle permits passage of shafts that may be longer than the machine — another typical advancement that means greater versatility and usefulness.



Advanced Design includes combined lever and handwheel operated footstock, electrical controls grouped in raised cabinet, pumps and motors easily accessible, table-ways pressure-lubricated from outside reservoir, ramped outlet from coolant tank to assist clean-out.

To Economize, Modernize With **NEW**

NORTON

GRINDERS and LAPPERS

Making better products ... to make other products better

District Sales Offices: Worcester • Hartford • New York
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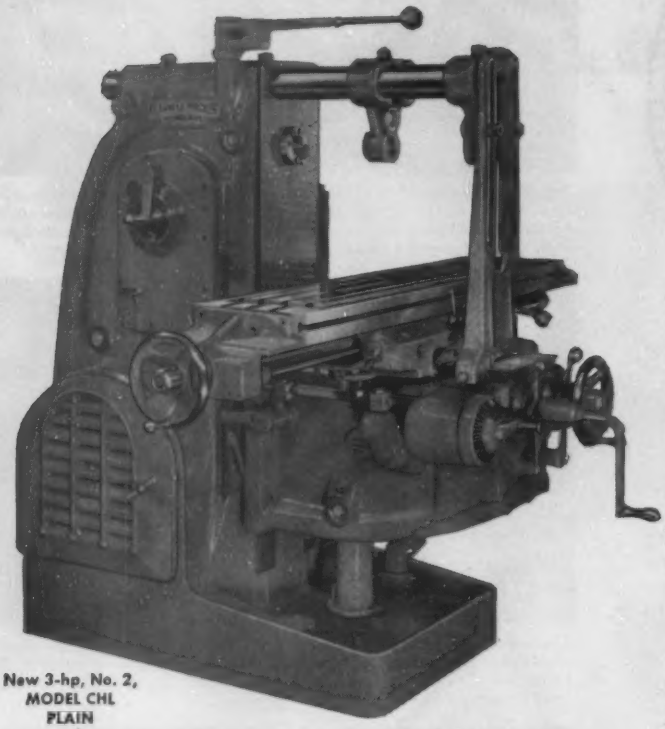
LESS THAN 23 CENTS PER HOUR



New 3-hp, No. 2, MODEL CHL PLAIN

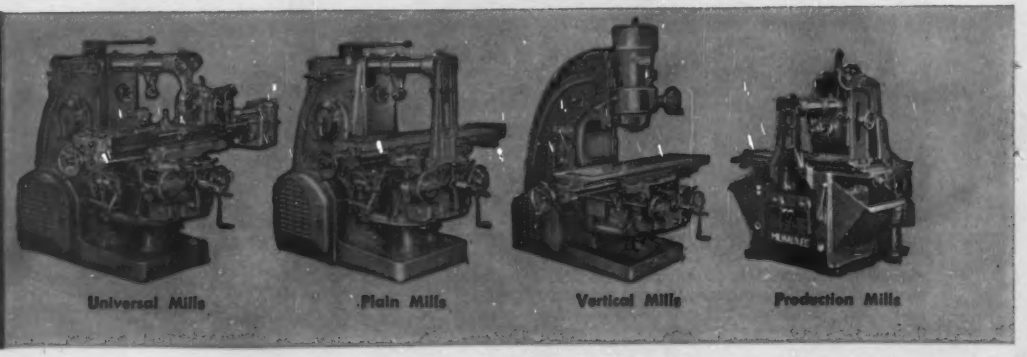
...will put this new 3-hp, No. 2, Model CHL plain milling machine to work in your plant with...

Kearney & Trecker's

TOOL-LEASE

PROGRAM

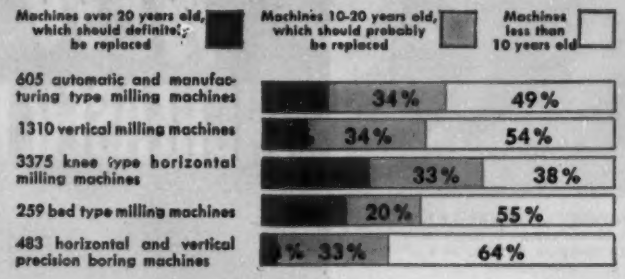
Kearney & Trecker manufactures a complete line of more than 250 standard, knee and bed type milling machines and precision boring machines.



Universal Mills | Plain Mills | Vertical Mills | Production Mills

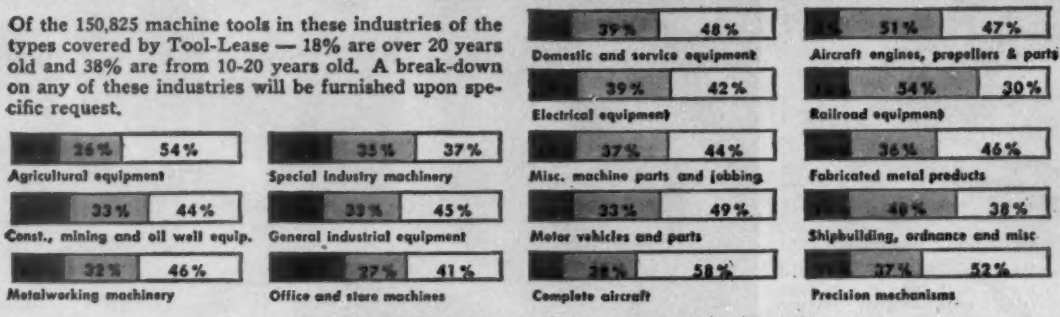
LET'S LOOK AT THE OBSOLESCENCE PICTURE IN THE GENERAL INDUSTRIAL EQUIPMENT INDUSTRY

Here's the picture in a typical industry — GENERAL INDUSTRIAL EQUIPMENT — (see chart at right). Of the 6032 standard knee type horizontal, vertical, bed and manufacturing type milling machines and precision boring machines in use today — which can be replaced by Tool-Lease equipment — 22% are more than 20 years old, 33% are 10 to 20 years old, 55% are more than 10 years old!



HERE'S THE OVERALL PICTURE IN THE ABOVE AND 15 OTHER BASIC INDUSTRIES

Of the 150,825 machine tools in these industries of the types covered by Tool-Lease — 18% are over 20 years old and 38% are from 10-20 years old. A break-down on any of these industries will be furnished upon specific request.



Figures adapted from 1953 American Machinist survey of metalworking industry

NO! We didn't make a mistake. Under Tool-Lease Plan "A", one of three seven-year lease agreements offered by Kearney & Trecker, you are asked to make two semi-annual rental payments, totaling 25% of the machine's price during each of the first three years. Actually, in dollars and cents, you are asked to invest approximately 23 cents per hour for a new 3-hp, No. 2, Model CHL plain milling machine. That means a machine installed in your plant and in operation — *for pennies an hour!*

What's more, under Tool-Lease, you can rent any of over 250 standard milling machines or precision boring machines. All are available under three basic plans, with varying options to continue or terminate the lease, or to purchase the equipment. If you require special machinery or heavy-duty CSM bed types, special agreements will be considered.

GET ALL THE FACTS NOW!

For complete information on Tool-Lease . . . help in analyzing your milling and/or precision boring needs — see your Kearney & Trecker representative or mail coupon to Kearney & Trecker Corp., 6784 W. National Avenue, Milwaukee 14, Wisconsin.

TOOL LEASE
KEARNEY & TRECKER
MILWAUKEE
MACHINE TOOLS
EQUIPMENT ®

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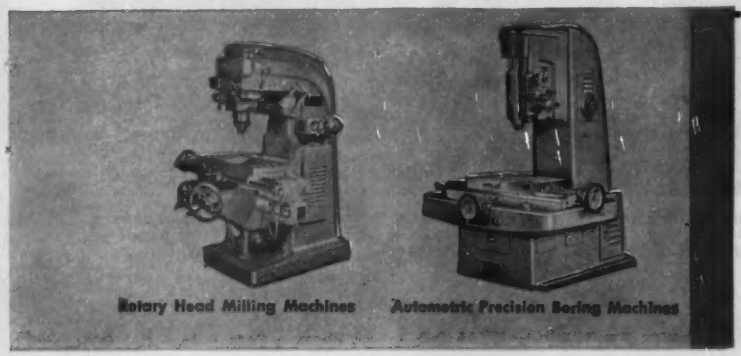


KEARNEY & TRECKER CORP.
6784 W. National Avenue
Milwaukee 14, Wisconsin

Please send me Bulletin TL-10A on Tool-Lease Program and booklet titled "Critical Picture of Creeping Obsolescence" or call Milwaukee, GReenfield 6-8300.

Name.....

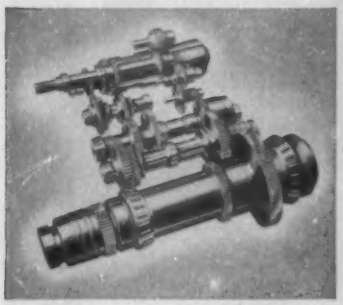
Title.....

Company.....

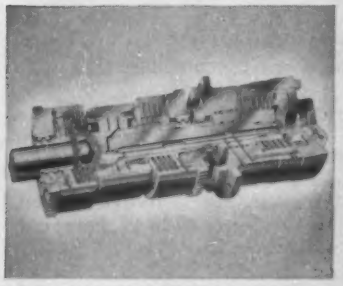
Address.....

City..... Zone..... State.....

MORE POWER – as much as you'll need for any job! Motor range: 2-A, 15 to 40 hp.; 3-A, 25 to 60 hp.; 4-A, 30 to 75 hp.

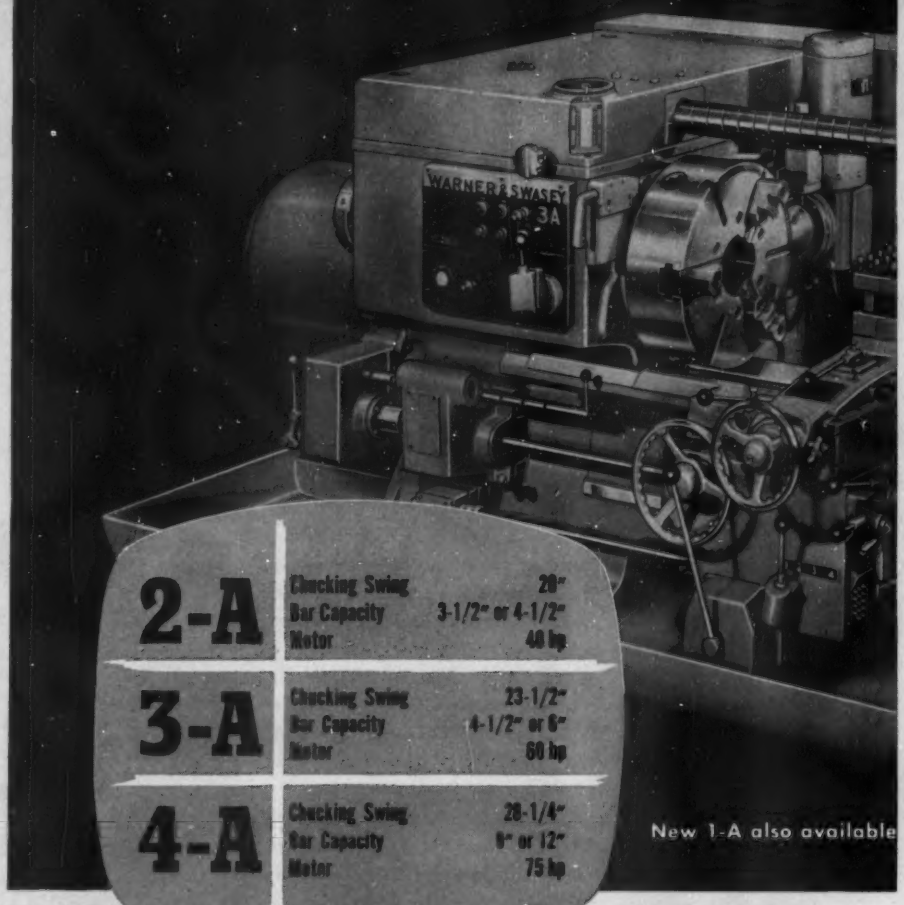


16-SPEED DRIVE provides closer grouping of speeds in natural work range to turn more work diameters more effectively – increase production and tool life. 2-speed motor provides 32 *un-duplicated* speeds!



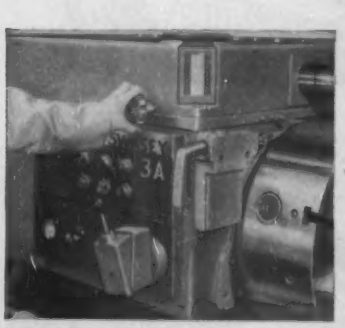
MAINTENANCE-FREE, instant-acting forward and reverse clutch and headbrake unit never needs adjustment – engage smoothly and virtually instantaneously providing fast starts, stops, and reverses.

NEW WARNER & SWASEY INCREASED EFFICIENCY, GREATER

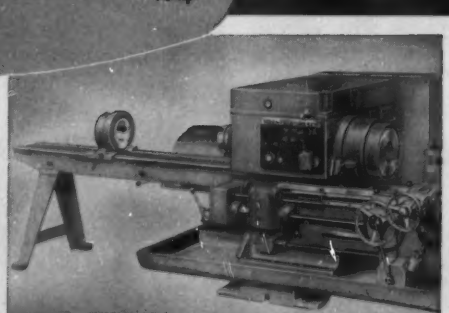


2-A	Chucking Swing	20"
	Bar Capacity	3-1/2" or 4-1/2"
	Motor	40 hp
3-A	Chucking Swing	23-1/2"
	Bar Capacity	4-1/2" or 6"
	Motor	60 hp
4-A	Chucking Swing	28-1/4"
	Bar Capacity	9" or 12"
	Motor	75 hp

New 1-A also available



SPEED PRE-SELECTION made easy by large direct reading indicator dial. AUTOMATIC GEAR SHIFTING boosts production, reduces operator fatigue. A single movement of the control handle without any further attention by the operator slows spindle to crawl speed, then shifts to new speed—all in a matter of seconds.

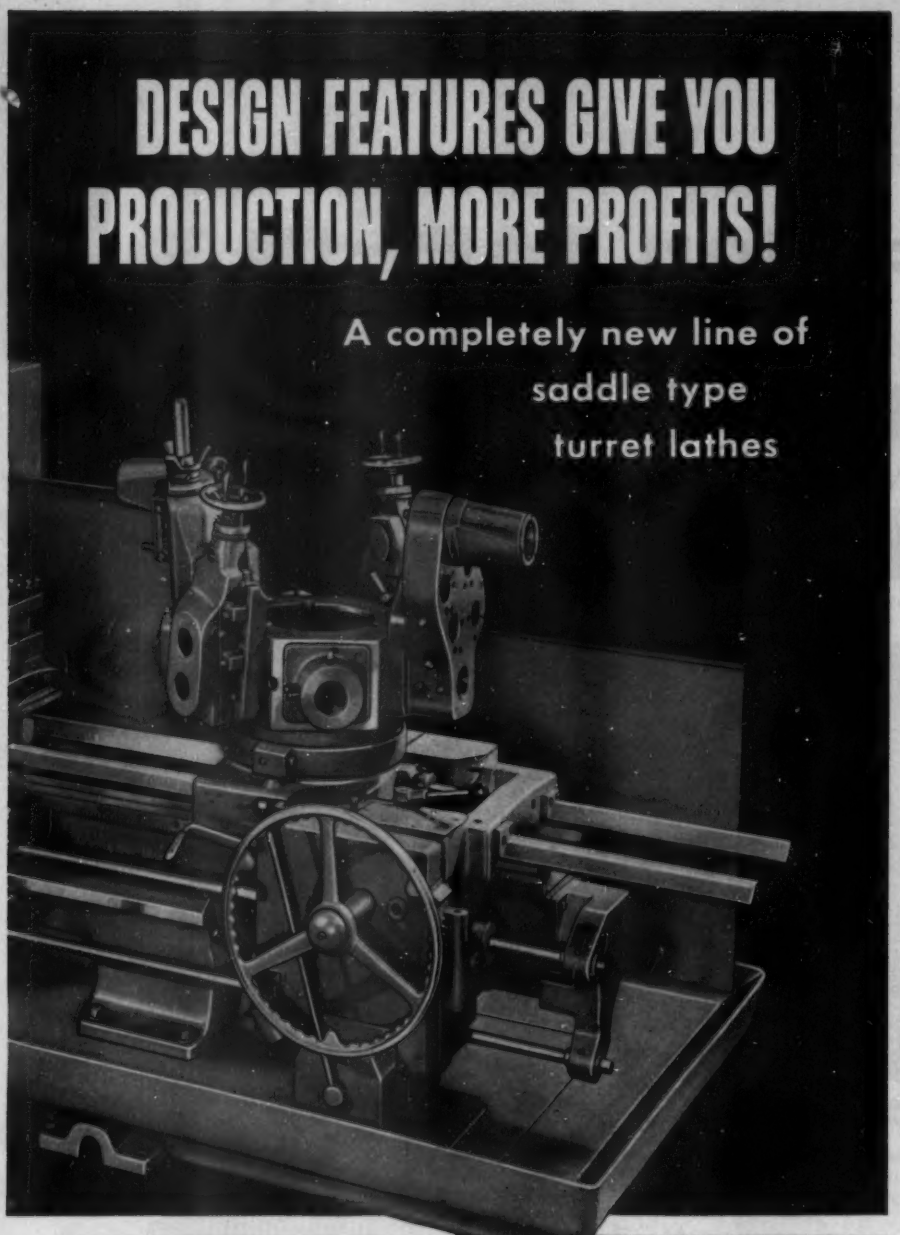


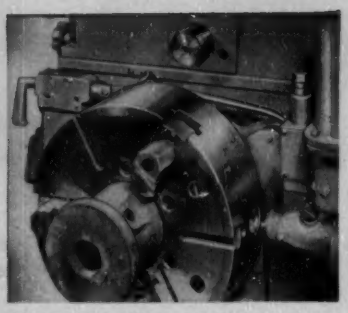
NEW HYDRAULIC CHUCK AND BAR FEED and power return. Provides easier handling, less operator fatigue – increased production.

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS WITH WARNER &

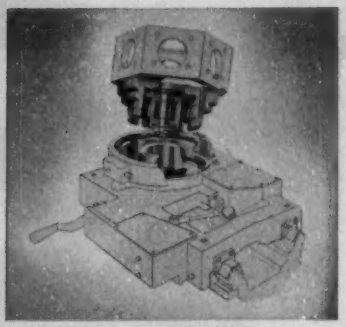
DESIGN FEATURES GIVE YOU PRODUCTION, MORE PROFITS!

A completely new line of saddle type turret lathes

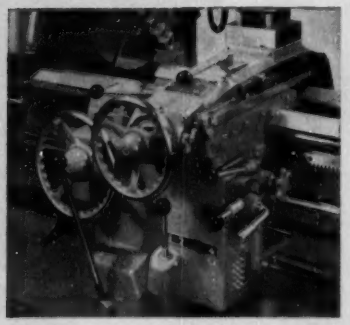




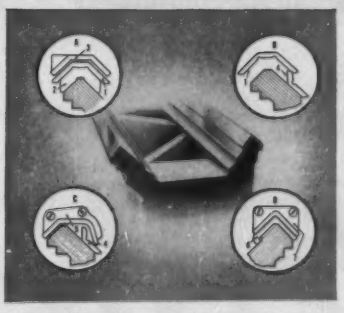
NEW POWER CHUCK WRENCH eliminates back-breaking effort when chucking. Grips and holds delicate work or heavy forgings. Does not obstruct spindle bore.



ACCURATE LOCATING AND LOCKING HEX TURRET assures maintained accuracy. Single lever controls both locating and clamping of turret.



FAST OPERATING CROSS SLIDE. All controls within easy reach. 4-way traversing with rapid traverse lever. Monoshift lever provides fast feed changes. Open type square turret for flexible tooling.



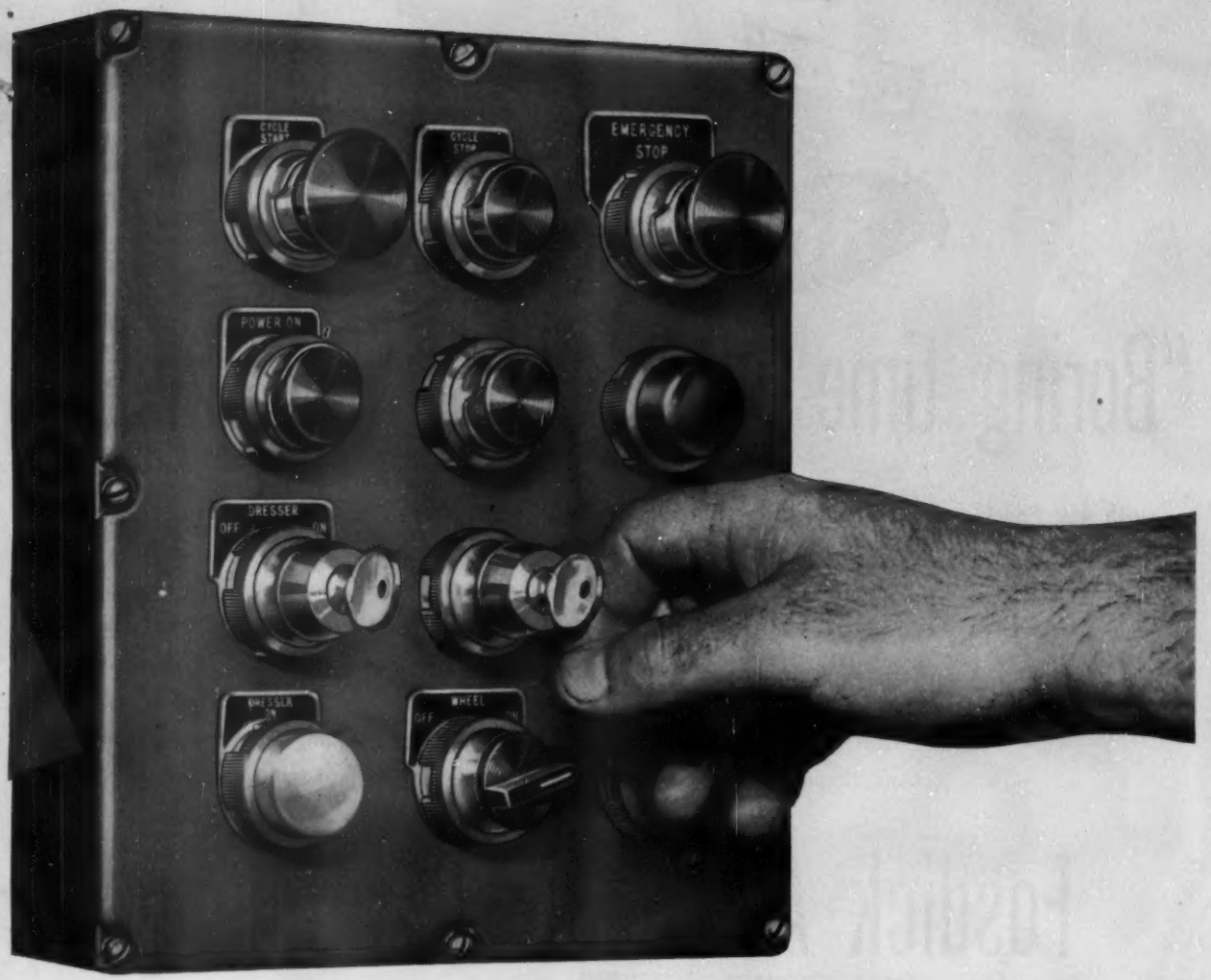
INDUCTION HARDENED VEE-BEDWAYS assure long accurate life. Exclusive way covers protect bearing surfaces from damage by dropped tools, chips, and loss of way lubrication.

INCREASED STRENGTH WITHOUT INCREASED WEIGHT. Scientific diagonal rib design gives over 30% added strength—greater rigidity and long-term accuracy.

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

SWASEY MACHINE TOOLS, TEXTILE MACHINERY, CONSTRUCTION MACHINERY

Your NEW KEY to Precision TAPPING



Now Morse takes another giant step ahead . . . this time with "Vectormatic" Tap-Thread Grinding . . . an entirely new process that includes an entirely new method of close-tolerance gaging.

The tap is sized by exclusive Vectormatic "Magic-Mike" control. Size control mechanism and the adjusting segment of the circuit are *completely locked-in*, to insure uniformity.

In the whole operation, the work is never touched by the gaging mechanism, which is controlled by an invisible wall of electrons activating a series of relays. Control mechanism is unaffected by voltage fluctuations and vibrations.

That's why Morse Vectormatic Thread Grinding is the most precise method in use today . . . and why Morse Taps are now, even more than ever before, your best buy. Call your Morse-Franchised Distributor *now* . . . your only source for Vectormatic Ground Taps.

MORSE TWIST DRILL & MACHINE COMPANY
(*Division of VAN NORMAN COMPANY*)
NEW BEDFORD, MASS. • *Warehouses in* New York, Detroit, Chicago, Houston, San Francisco

MORSE
Cutting Tools

. . . buy them by phone from your Morse-Franchised Distributor and save ordering time

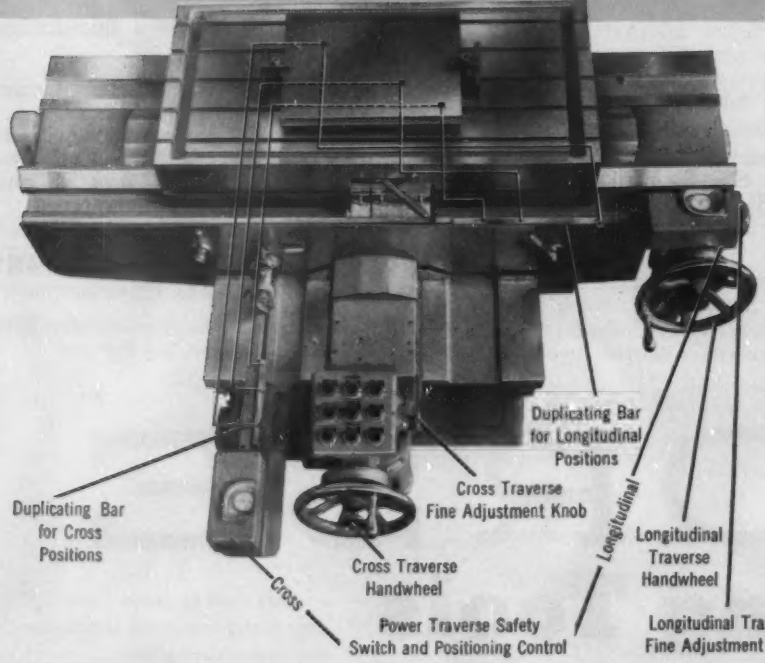
Here's another reason it pays to get a proposal from Fosdick

"Boring time cut 25% on 'one-time'

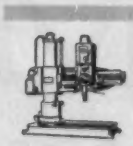
with our Fosdick Automatic Positioning Jig Borer," says Hiser Jig Grinding Co.

"We had to hold a tolerance of ±.0005" on the index and some 30 locating and bushing holes on a multiple spindle drill jig. This jig is used to drill a housing control valve for the power steering attachment of a large automobile manufacturer. Using our Fosdick Jig Borer with Automatic Positioning, we were able to hold this tolerance easily and finish the job in record time. Our Fosdick takes care of our large variety of precision drilling and boring operations on tools, dies, gages, fixtures and jigs. We are glad we got our proposal from Fosdick."

Fosdick Automatic Positioning



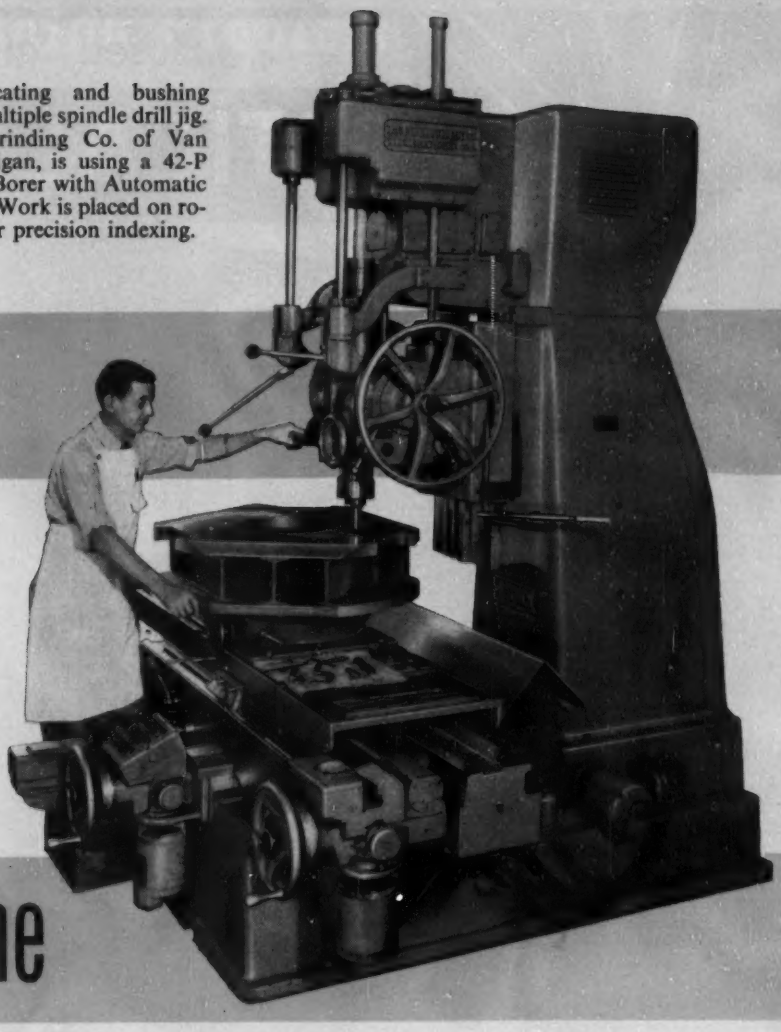
Top view of positioner showing location of duplicating bars in troughs, typical job set-up of table. Note how bars locate hole centers in the work, lengthwise and crosswise. For operator convenience, bars are located within easy reach. Holes in bars are keyed with letters and numbers to identify them at a glance with holes in the work. On "one-time" jobs, measuring rods can be used in place of bars.



Radial Drills

Drilling locating and bushing holes in a multiple spindle drill jig. Hiser Jig Grinding Co. of Van Dyke, Michigan, is using a 42-P Fosdick Jig Borer with Automatic Positioning. Work is placed on rotary table for precision indexing.

jobs



saves time

on 'one-time' jobs as well as precision production.

Fosdick builds Automatic Positioning into its Jig Borers to give you ±.0001″ table positioning *in seconds* simply by pressing a button. Automatic Positioning can cut the cost of boring jigs, or can eliminate jigs entirely. Gives exact reproduction of drilled, bored, tapped and reamed parts. You get rapid precision in production or one-time jobs, without experienced operators. For fast tool changing with Automatic Positioning, the Fosdick BF Spindle enables you to change tools in seconds, while the machine positions . . . repeating hole size to ±.0001″ without resetting.

For full information on the Fosdick Jig Borer with Automatic Positioning, send for Catalog 17P-A.

Need Drilling Equipment? Get a Proposal from Fosdick!

Jig Borers

Sensitive and Upright Drills

Sensitive Radial Drills

Automatic Positioning Machines

FOSDICK

THE FOSDICK MACHINE TOOL CO., CINCINNATI 23, OHIO

fused quartz

VK OPTICAL FLATS

Accurate to .000001"

With VK Optical Flats, close checking of flat surfaces is simplified and more conveniently handled.

Shown here is the new Van Keuren monochromatic light, 22¼" wide, 17¼" high and 20" deep (in bench space). It is designed for use with large optical flats such as the one shown—a 10" diameter fused quartz double-surface master flat (accurate to .000001" both sides).

VK Optical Flats are available in sizes from ½" diameter to 10" diameter in .000001", .000002", or .000004" accuracy. They can be shipped within 30 days from order.

Catalog and Handbook No. 35 is available by writing: The Van Keuren Co., 173 Waltham St., Watertown, Mass. Ask for your copy.

VK

35th YEAR

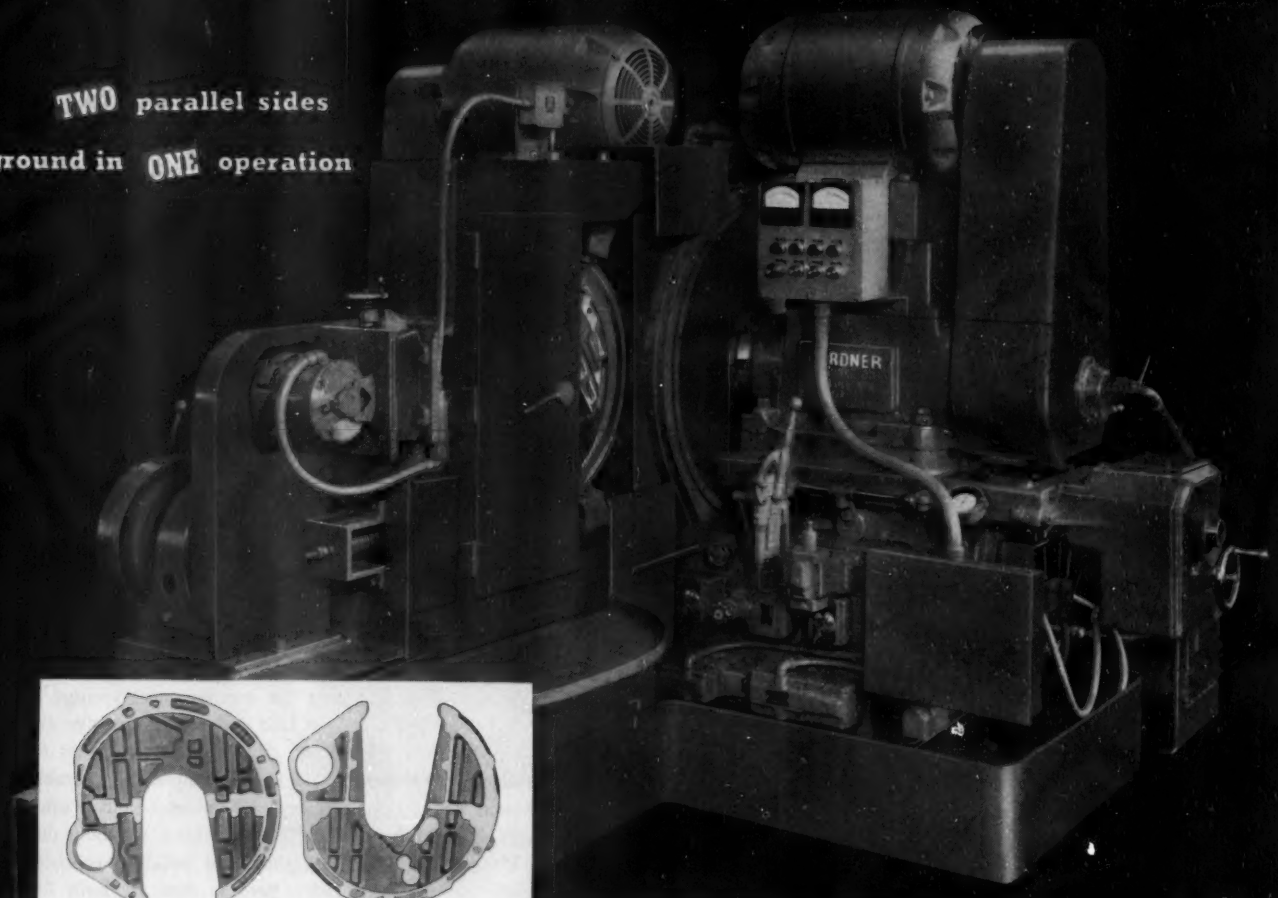
THE Van Keuren CO.,

173 WALTHAM STREET, WATERTOWN, MASS.

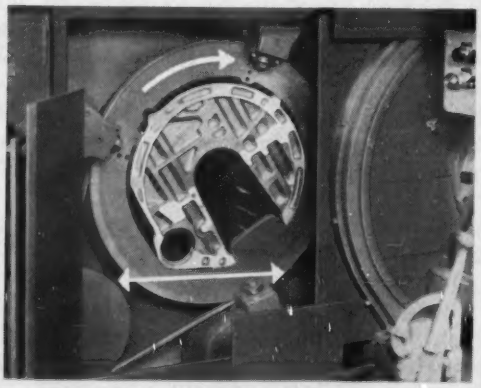
Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Cemented Carbide Plug Gages • Carboloy Cemented Carbide Measuring Wires • Chrome Carbide Taper Insert Plug Gages

Unusual Grinding Problem Solved by "Floating" Principle of Gardner Grinding

TWO parallel sides
ground in **ONE** operation



1. Interrupted Cut 2. Irregular Shape 3. Unequal Areas



work data

MACHINE	Gardner No. 125-30" Double Spindle Grinder.
PART	Torque converter adapter plate of aluminum alloy.
PRODUCTION	90 plates per hour.
STOCK REMOVAL	.100" overall.
TOLERANCES	.001" for parallelism and uniformity.
TOOLING	Hydraulically-oscillating work table with power driven, rotating work fixture. Work piece radially driven and free to float sidewise between the discs.
ABRASIVES	2 Gardner Yellow Rim Wire Lokt Abrasive Discs.

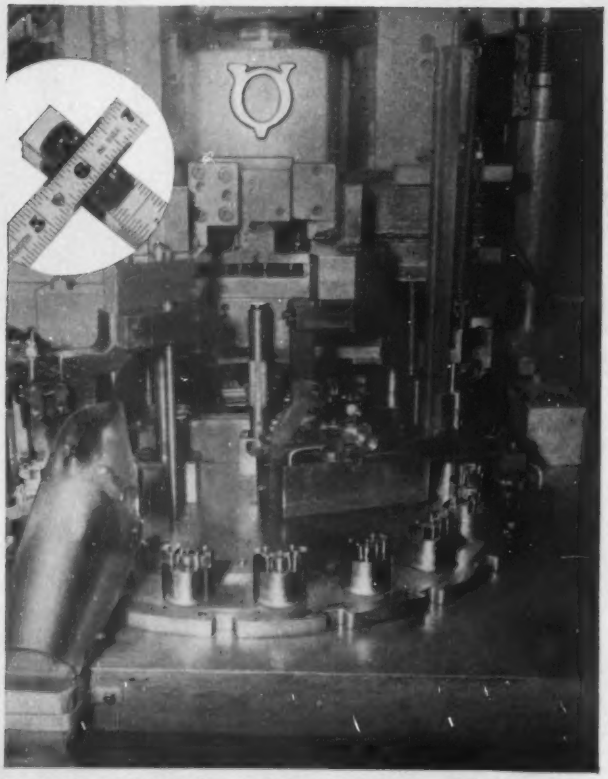
GARDNER MACHINE COMPANY
410 Gardner St., Beloit, Wisconsin, U. S. A.

132M

GARDNER
precision disc grinders

In continuous cycles the V & O #50S Press with dial feed turns out 20,000 complete clamp assemblies for folding wood rules in the regular working day. From right to left—the spring is stripped from a magazine, the female and male clamp halves are formed, an eyelet inserted and expanded, and the complete assembly delivered to a hopper.

AUTOMATED V&O PRESS BOOSTS MAN-HOUR PRODUCTION 2000%



The 18 station dial feed on the V & O #50S Press at the Master Rule Mfg. Co. has supplanted 13 smaller presses and more than tripled total daily production. So accurate is the alignment of the press that the dies are removed for sharpening only after each five-millionth piece. Production per man-hour is up over 2000 per cent.

Fourteen men and fourteen machines, working an overtime schedule, previously produced 6,000 clamps for wood folding rules a day at Master Rule Mfg. Co., Middletown, N. Y. Now, one of the original presses, a V & O No. 0, makes the stainless steel springs. A V & O No. 50S with dial feed and two progressive dies has taken the place of the other thirteen machines for producing the clamp halves and completing assembly. Present production, with two machines and two operators, is in excess of 20,000 clamps for a 7½ hour day.

V & O has been designing and building precision power presses since 1889. Because they are built like precision machine tools you can safely use the clever and expensive tooling required for automation. With automated V & O presses you can depend on higher precision production and you can count on lowered unit costs.

Our representatives will be glad to show you how V & O automation can make your operations more productive and more profitable.

THE V&O PRESS COMPANY

DIVISION OF EMHART MFG. CO.

HUDSON, NEW YORK

BUILDERS OF PRECISION POWER PRESSES AND FEEDS SINCE 1889

65th Anniversary

Only the best is good enough

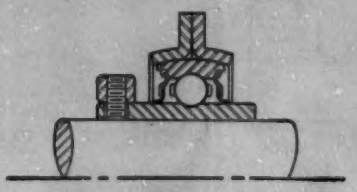
Link-Belt JPS-200 ball bearings are standard equipment on Scott Urschel beet harvester.

BEARING PROBLEM?

READY ANSWER:

Series JPS-200 Ball Bearing Pillow Blocks are part of Link-Belt's line of pillow blocks, flanged, flanged cartridge, cartridge, hanger and take-up blocks and unmounted bearings.

MAXIMUM SEALING EFFICIENCY. Synthetic rubber lip-type seal, integral with bearing, retains lubricant and excludes dirt. Greased at factory, bearing requires no further lubrication.



ALIGNING SURFACE of housing is precision coined to assure proper fit and support of bearing and to permit maximum misalignment in all directions.

New, low-cost LINK-BELT precision ball bearing combines efficiency, economy

COST has often prohibited use of ball bearings on light-duty equipment. But no more! With Link-Belt's new JPS-200 Series, you get all the advantages of precision anti-friction bearing performance at low cost. The sturdy, pressed steel housing permits economy without sacrificing performance.

Designed for applications where speeds are relatively low and loads are light, JPS-200 bearings incorporate a precision, deep-groove, single-row ball bearing, assuring smooth operation and freedom from wear. They're available for ⅜ to 1¼-in. shafts.

Whether it's low speeds with light loads . . . heavy duty under abrasive conditions—whatever the application—there are Link-Belt ball and roller bearings that meet every requirement. For all the facts on industry's most complete line of mounted and unmounted ball and roller bearings, ask your Link-Belt office or authorized stock carrying distributor for Data Book 2550. And for complete information on the new JPS-200 ball bearing, write for Folder 2517.

LINK-BELT

BALL and ROLLER BEARINGS

LINK-BELT COMPANY: Executive Offices, 307 N. Michigan Ave., Chicago 1. To Serve Industry There Are Link-Belt Plants, Sales Offices, Stock Carrying Factory Branch Stores and Distributors in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World.

13.642

we're blushing with pleasure!

One of our customers, who recently called to order his fourth Blanchard Surface Grinder, made us blush with pleasure.

"It's a shame," he said, "that every machine shop owner doesn't know as much about Blanchards as I know.

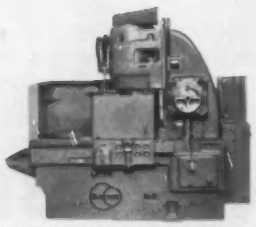
"I use 3 Blanchards almost around the clock in my contract machining business. They make it possible for me to do work much more economically—and in a great deal less time—than my customers can.

"For example, one of my customers had been grinding 1/8" of stock off both sides of 3" x 4" 4140 steel blocks, to a dimension tolerance of ± .0005". The fastest method in his shop involved turning the blocks in a chucking lathe and then grinding them in three operations on his grinder.

"We put the blocks, 17 per load, on a Blanchard and ground them to size . . . *in exactly the same time that my customer needed to turn 5 blocks before grinding.*

"If you could tell every machine shop owner that story, you'd sell more grinders than you could build."

We're following his suggestion!



NO. 18 BLANCHARD SURFACE GRINDER

Send for your free copies of "Work Done On The Blanchard", fourth edition, and "Art of Blanchard Surface Grinding"

PUT IT ON THE BLANCHARD

THE BLANCHARD MACHINE COMPANY **64 STATE ST., CAMBRIDGE 39, MASS., U.S.A.**

Production Pointers from GISHOLT

TIME-SAVING IDEAS

Presented as a service to production men, we hope some of these interesting ideas, chosen from thousands of jobs, will suggest ways to help you cut time and costs in your own work.

SAVING TIME ON 6 TYPES—AND 24 SIZES

No. 24 Hydraulic Automatic Lathe with Hydraulic Tracer Unit Speeds Output of Bearing Races

Put new zip and lower costs into bearing race production with *six* different types and 24 varying sizes? And do the whole job on only *one* machine? Sounds like quite an order, doesn't it?

It's really a pushover with the No. 24 Hydraulic Automatic Lathe—equipped with the Gisholt Hydraulic Tracer Unit. This user shows how inner and outer bearing races requiring spherical, straight or tapered bores can be handled with speed and ease.

In the first operation, longitudinal movement of the front carriage and transverse movement of the standard slide permit tools to turn the O.D. up to the chuck jaws and face the forgings. The longitudinal movement of the rear carriage carries the tooling toward the spindle, and the template-controlled Hydraulic Tracer Unit actuates the rear slide, causing tools to rough-generate the spherical bore (for this typical 18" O.D. part) and break the corners at the end of the cut.

Tracer Unit Holds Fine Tolerances

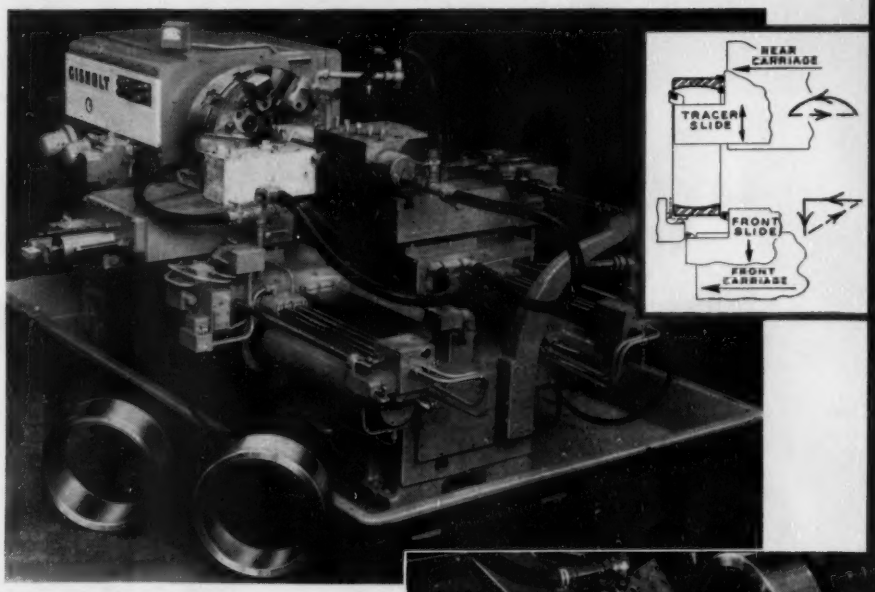
For the second operation the template is quickly re-located and the stops changed. Tools on the front slide finish turn the O.D. and face the other side. Tools on the tracer-controlled rear slide finish-generate the spherical bore, holding a .0005" tolerance, and then break the corners.

Each operation takes just 8 minutes f.t.f. with 90 lb. of tough bearing steel removed in less than 16 minutes total machining time. That's really knocking 'em out!

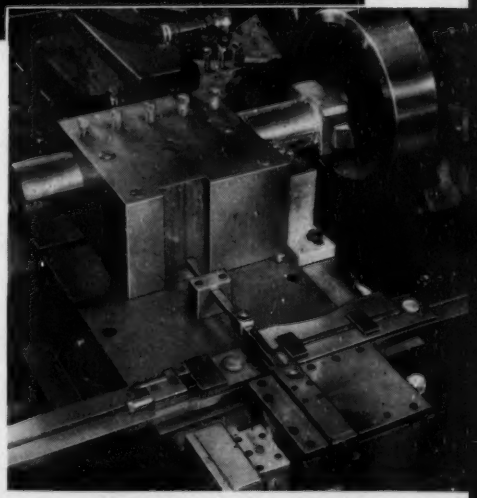
The Gisholt Hydraulic Tracer Unit operates at high pressure with slide movements controlled by a template and stylus-type follower. Square faces can be machined and cuts of ¾" depth at .035" feed are easily made. Setup is quick with convenient micrometer adjustment screws for accurate slide and template positioning.

The Hydraulic Tracer Unit is adaptable to other machines, too, for solving a wide variety of production problems. Your Gisholt representative can tell you about it and the No. 24 Hydraulic Automatic Lathe.

Quick changes for doing spherical, straight and tapered boring in a multitude of parts have one simple solution . . . the Gisholt Hydraulic Tracer Unit.



No. 24 Hydraulic Automatic Lathe set up for bearing race production.

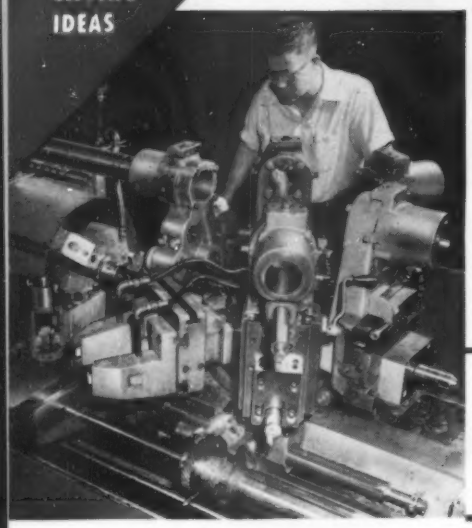


The hydraulic tracer controlled rear slide arrangement. Note the micrometer settings for positioning the template.

TIME-SAVING IDEAS

HERE'S SOME TICKLISH INTERNAL BORING AND FORMING—*Done With Standard Slide Tools*

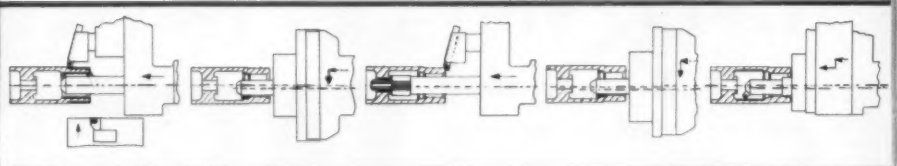
How the Gisholt Fastermatic Automatic Turret Lathe Reduces Time and Costs



The producers of these parts had the problem of going through an outer small diameter bore in order to get to a larger diameter bore inside. Ticklish as it sounds, they came up with "stock" tool answers to keep costs down.

The job's being done on a Gisholt 2F Fastermatic Automatic Turret Lathe with slide tools mounted on hexagon turret stations and operated by the standard back-facing attachment on the rear cross slide. After the tools have reached required depth through the small bore, the back-facing attachment actuates the slide which carries the tool the short distance necessary to complete internal machining operations. The workpieces—which are malleable iron valve castings—are machined in a floor-to-floor time of 4.2 minutes.

Here standard tools working in close quarters cut costs with internal boring and forming of castings completed in one fast, automatic cycle.



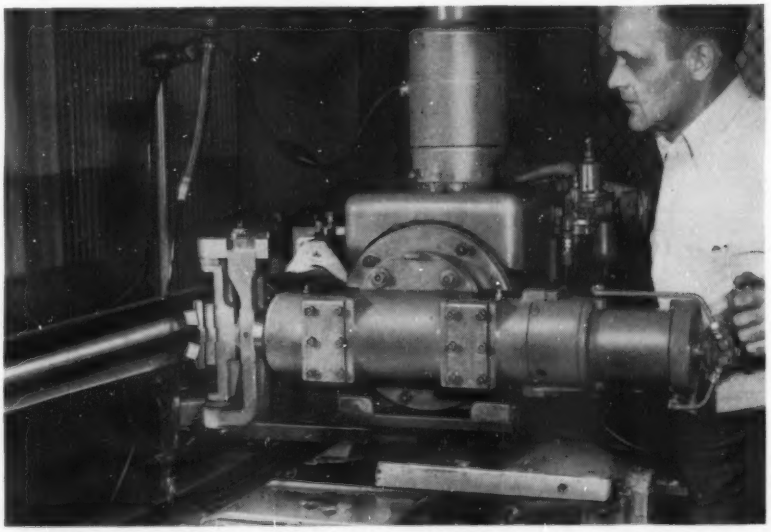
SAVES UP TO 3½ HOURS PER PART...INSURES BETTER CHROME PLATING BY SWITCH TO SUPERFINISH

Inexpensive Attachment for Turret Lathe

Long life and fine operation make it necessary that these forged steel piston rods for hydraulic presses be chrome plated. Production was slow and costly—penalized by a polishing operation which required four hours to complete.

A dramatic answer to this time problem was provided by Superfinishing. Now, the piston rods are turned on this Gisholt 3L Saddle Type Turret Lathe and Superfinished via an inexpensive attachment—right on the lathe. There is no polishing operation this way; only 30 minutes are needed to Superfinish. The saving in time: 3½ hours!

Not only is the geometry of the piston rod improved by Superfinishing, but the surface is also brought down to true base metal which permits excellent, hard chrome plating. In this case, the turned surface of approximately 150 micro-inches R.M.S. is refined to a 5 to 7 micro-inch surface finish.



Surface finish on the piston rod is improved by Superfinishing over the former polishing method.

This simple attachment on a Gisholt Turret Lathe reduced a four-hour polishing operation to a thirty-minute Superfinishing job. Costs are lower, results much better.

The new SUPERFINISHING CATALOG tells about this important process, shows many interesting jobs. Write for yours.

GISHOLT

TIME-SAVING IDEAS

NOTHING LIKE THE CROSS-FEEDING HEXAGON TURRET FOR JOBS LIKE THIS

Heavy Parts Simultaneously Machined at Both Ends

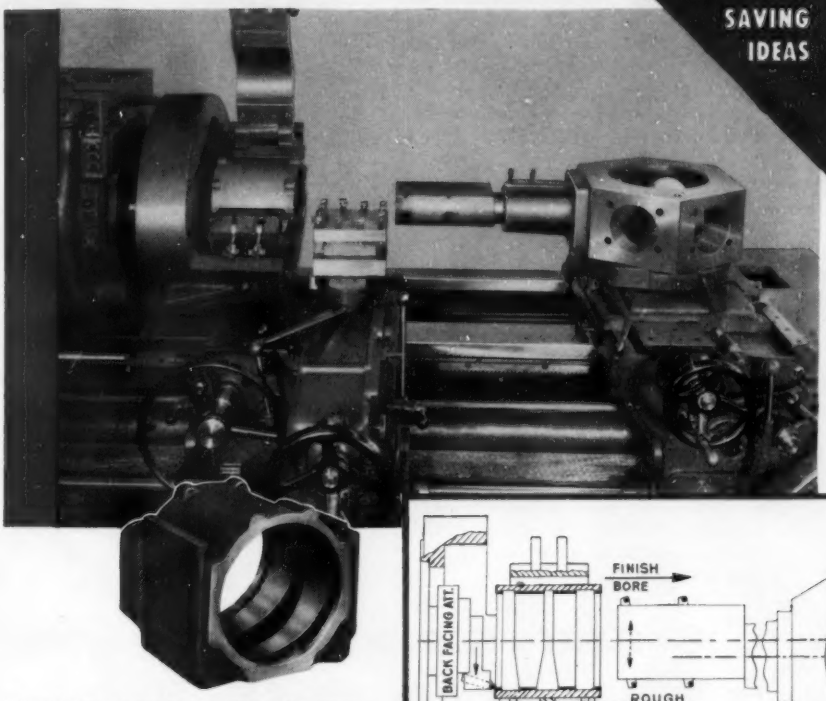
Not every lathe can make such a simple job of work like this: rough and finish boring . . . while simultaneously facing both ends of a part.

This Gisholt 4L Saddle Type Turret Lathe is doing it to these railroad bearing journal boxes. The cast steel workpieces are loaded by crane in the fixture.

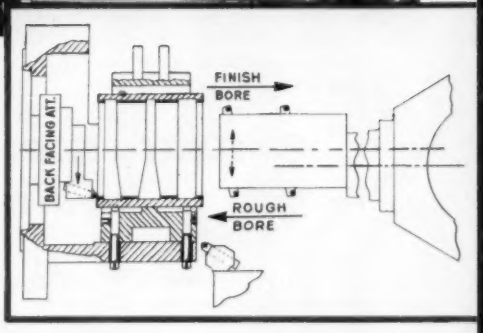
The cross-feeding hexagon turret carriage is equipped with solid positive stops on the front and rear which take care of sizing the bore for both the forward feed and reverse feed machining operations. Two tools are on both the front and back of the boring head, thus splitting up the cut.

For rough boring, the hexagon turret is brought forward to the front stop and then fed into the work. When boring is completed, the hexagon turret is moved back to the rear dead stop and fed outward for finish boring. A back facing attachment within the spindle faces one end, and the square turret tool faces the other end.

This unique tooling setup is used for machining 9 different sizes of workpieces with f.t.f. time ranging from 23 to 31 minutes.

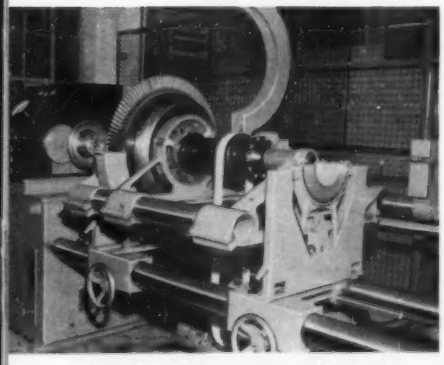


When fixture is closed and machine starts, cross-feeding hexagon turret tools you see do rough boring. Tools on other side do finish bore on reverse feed.



A SIMPLE SOLUTION TO SPECIAL BALANCING PROBLEM

Gisholt Balancing Machine Locates Dangerous Unbalance in Jet Engine Part



Jet engine turbine rotor assembly ready for precision balancing. Shroud is lowered over rotor during balancing operation.

Gisholt Balancing School—offers complete courses in theory and practical application of balancing to help with your particular problems. For complete details, starting dates, write today.

Unbalance causes vibration, and vibration means trouble. Bad trouble in the case of this jet engine turbine rotor assembly if it were allowed to remain. That's why precision balancing is such an important part of production.

A Gisholt DYNETRIC 3UJP Balancing Machine is used for dynamically balancing every assembly. Placed in a special cradle, the unit is rotated on its own bearings. Shrouding is provided to reduce air load.

Taking direct readings from the machine, the operator quickly corrects unbalance by adding steel weights in a balance-ring groove machined on the outside face of the turbine wheel for the left correction plane—and by adding washers to bolts for the right correction plane. The result is balance of unbelievably low tolerances, completely smooth operation.

Precision balancing can make your rotating parts and products better performing . . . and more lasting. Gisholt balancing equipment is adaptable for virtually every balancing problem.

Providing balancing correction facilities in the original design speeds up this vital balancing operation.

DYNETRIC BALANCERS — GISHOLT

DEVELOPED JOINTLY WITH WESTINGHOUSE ELECTRIC CORPORATION. "DYNETRIC" IS A TRADE MARK REG. U. S. PAT. OFFICE BY WESTINGHOUSE ELECTRIC CORPORATION

There is full information in the booklet, GISHOLT BALANCING MACHINES. Ask your Gisholt representative, or write direct for your copy.

GISHOLT

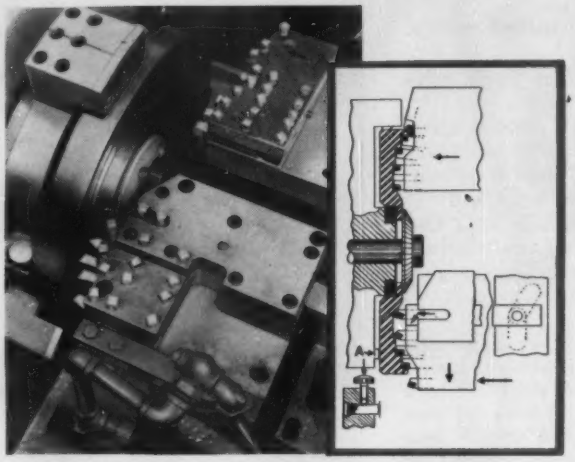
TIME-SAVING IDEAS

BUNCHING UP OF CUTS FINISHES LARGE PARTS FAST

Simplimatic Pulls 11 Tools at Once to Cut Costs!

These large steel flywheels require boring and facing on several diameters—plus special angle facing. The best approach to the problem was found in the Gisholt Simplimatic Automatic Lathe. This permitted combining all operations in one setup.

The 19" flywheel is held by an air-operated drawback fixture. The job starts with tools on the front slide being table fed to cutting position. Normal slide movement then carries the tools away from the spindle centerline, finish facing three step faces and the rim face. The hub angle is finish faced with a tool held in a sliding tool holder mounted inside the main tool block and controlled by a special cam. Tools on the rear slide finish bore three co-bores, finish turn the hub and chamfer the rim O.D. and I.D. A total of eleven tools works simultaneously to finish this part in just 5.60 minutes f.t.f.



Tooling setup for machining flywheels. "A" shows spring jack for supporting edges of workpiece and preventing chance of distortion.

Close-up shows tooling arrangement on front and rear slides and sliding tool holder mounted inside the main tool block.

Straight and angular facing, plunging and facing, turning, boring and chamfering . . . all these cuts are taken simultaneously on the Simplimatic Automatic Lathe with speed that means minimum costs.

• • •

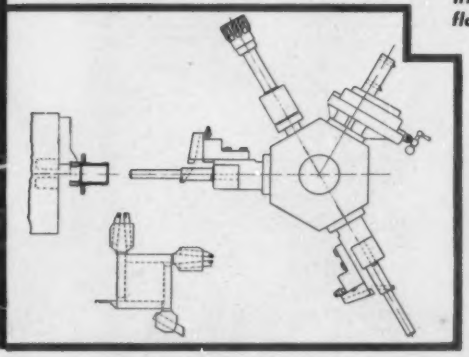
CHUCKING RING SAVES SECOND OPERATION

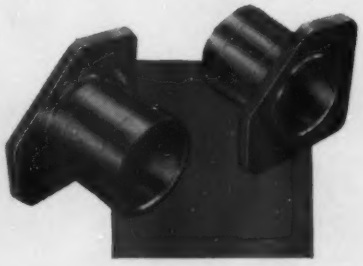
Gisholt Ram Type Turret Lathe Speeds Turning and Boring Work

Machining these bearing support bushings would normally be a two-operation job. But it isn't, because of the addition of a chucking ring to the casting. It's a case of the slight value of the cut-off stock being more than made up by savings in time and greater accuracy.

Tools on the hexagon turret bore, turn, face, ream and chamfer. At the same time, tools mounted in special double tool holders on the square turret rough and finish straddle-face the flange, form the O.D. relief and cut off to length. Time is only 3.5 minutes f.t.f.

By leaving a chucking ring on the workpiece, a second operation is eliminated, concentricity is assured as is parallel facing of flange. Saves machining time, too.





No. 9-1054
629

THE GISHOLT ROUND TABLE represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

GISHOLT MACHINE COMPANY

Madison 10, Wisconsin

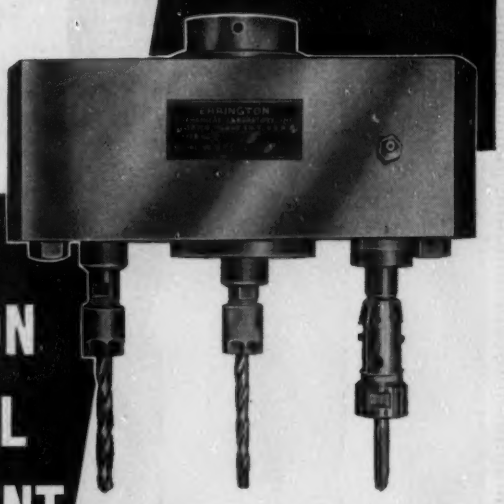
TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

FULLY ADJUSTABLE DRILLING HEAD

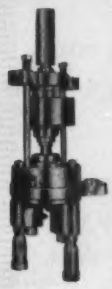
Here's a light, compact tool with a wide range of adjustment. Can drill on squares, rectangles, circles, triangles and irregular patterns.

NOW YOU CAN

- DRILL
- COUNTERSINK
- REAM
- COUNTERBORE
- TAP



Capacity to 1/4" drill and 5/16" tap. Available with 2, 3 or 4 spindles. Spindles spaced to handle work up to 5½" outside diameter.

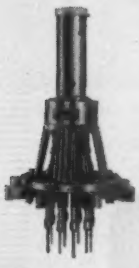


ADJUSTABLE TAPPING HEAD

Fully geared. Needle bearings on all spindles in head. Ball thrust bearings throughout. Bronze bushed. Sand cast aluminum case.

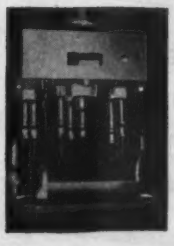
ADJUSTABLE DRILLING HEAD

This versatile tool permits you to take advantage of a wide range of adjustment without overhang.



UNIVERSAL JOINT DRILLING OR TAPPING HEAD

This dependable tool is adjustable to any pattern of holes. Available with 4 to 12 spindles. All aluminum housing construction, thrust bearings and gears turned on spindles.



MULTIPLE SPINDLE HEADS

Shown is a ten spindle multiple drilling head, drilling ten varied size holes on different elevations.

ERRINGTON TAP-DRILL ATTACHMENT

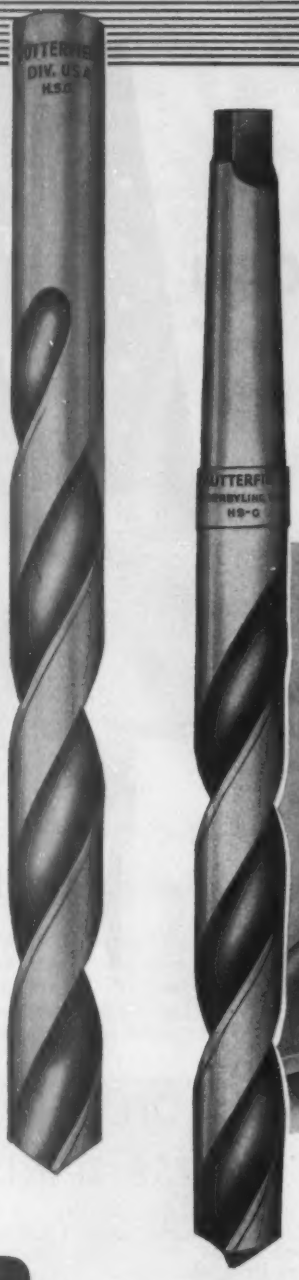
ALL ON ONE DRILL PRESS SPINDLE

...without taking your hand off drill press feed handle. Yes...with this new Errington Tap-Drill attachment, you simply slide the work under the head from one spindle to another. An automatic reversing tapping spindle is built in, making it unnecessary to reverse the drill press for tapping.

Hardened and ground spindles. Gears turned on spindles (not pinned on). Heavy duty grooved ball thrust bearings all enclosed in a sand cast aluminum case and cover.

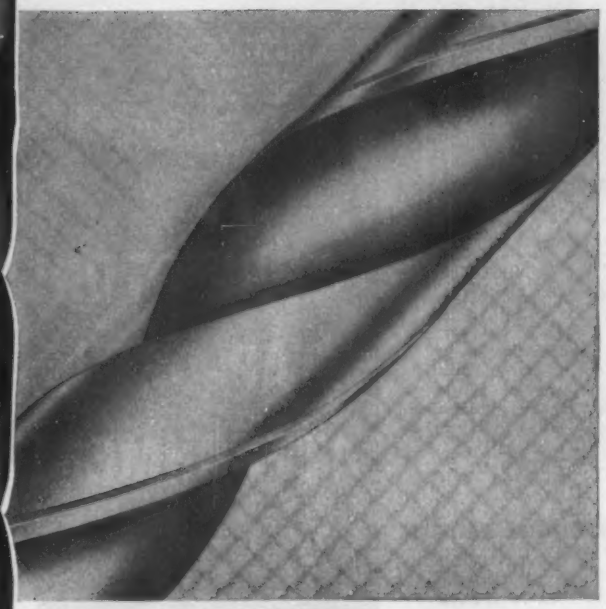
Send For Complete Information

ERRINGTON MECHANICAL LABORATORY, INC.
Established 1891
Main Office and Plant: STATEN ISLAND 4, N. Y.
Export Office: STATES TRADING COMPANY 401 Broadway, New York 13
Cable Address: STRADESCO, N. Y.



DESIGNED, ENGINEERED

Designed, engineered and produced for maximum performance — Butterfield Drills.



BUTTERFIELD

UNION TWIST DRILL COMPANY
BUTTERFIELD DIVISION
DERBY LINE, VERMONT, U. S. A.

TAPS • DIES • DRILLS • REAMERS • COUNTERBORES • SCREW PLATES

FOR BETTER SERVICE
Call Your
BUTTERFIELD
DISTRIBUTOR

More proof of how

Norton G Bond wheels boost O.D. grinding profits

Users praise "TOUCH of GOLD" performance that steps up production rate and quality while cutting costs

Users' Reports on Cylindrical Grinding

"*G Bond wheel* gave 50% more pieces per dressing, with greatly improved finish."

"*Grinding to .001"* limits, G Bond wheels removed stock faster, more uniformly. Gave more pieces per dress, with less spark-out time."

"*Cooler cutting*, crush-trues nicely, holds form. Best wheel ever used."

"*Ground sixty .075"* radius grooves per dressing, compared to 25 with previous wheel. This G Bond wheel, also used on critical shoulder job, held form and gave superior finish."

Cylindrical Grinding is faster, easier, more profitable when wheels made with the Norton G Bond — most efficient vitrified bond ever developed — add the "Touch of Gold."

Users' Reports on Centerless Grinding

"*G Bond wheels* produced better form and finish than any other wheels. Gave 50% more pieces per dressing on both rough and finish grinds. Also eliminated previous distortion of work due to overheating."

"*Dressing required* only once every 4 hours, instead of every 40 minutes. Best general purpose wheel ever used on our centerless machines."

"*Cut faster and freer,* held size better and gave better finish than previous standard wheel."

"*G Bond wheel* gave 16 hours longer wheel life and produced much better finish."

Centerless Grinding benefits by the G Bond's unique ability to hold each abrasive grain just long enough for maximum cutting action — an important "Touch of Gold" advantage.

New users are quick to recognize these advantages of G Bond wheels for O.D. grinding:

Cooler cutting action . . . faster stock removal . . . better finish . . . more pieces per dressing . . . longer wheel life . . . easier dressing, with less wear on diamond or on roll.

Added up, all these advantages mean valuable production economies and improvements in your product. That's why G Bond users have been glad to show their appreciation — with a steady stream of endorsements like those reproduced here.

Your Norton Distributor

is ready with proof of how G Bond wheels can add the work-speeding, profit-increasing "Touch of Gold" to your own cylindrical or centerless grinding jobs. Or write to NORTON COMPANY, Worcester 6, Mass. Distributors in all principal cities, listed under "Grinding Wheels" in your classified 'phone directory. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Massachusetts. W-1577

Making better products . . . to make other products better

NORTON

and its BEHR-MANNING division

NORTON: Abrasives • Grinding Wheels • Grinding Machines • Refractories
BEHR-MANNING: Coated Abrasives • Sharpening Stones • Pressure Sensitive Tapes

It pays you to use

BALANCED *Action* TAPS

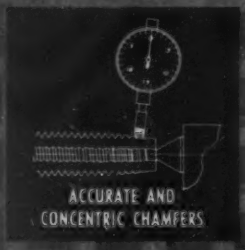
It takes care and skill to make taps that perform with BALANCED ACTION. Only Winter makes them.

It pays you to use BALANCED ACTION taps because of their accuracy—their longer life—and your saving in scrap losses.

EXACT FLUTE SPACING

UNIFORM FLUTE CONTOURS

PRECISION CHIP DRIVER CONTOURS



ACCURATE AND CONCENTRIC CHAMFERS

ALWAYS AT YOUR SERVICE

Your local Industrial Supply Distributor carries a complete stock of WINTER Balanced Action Taps

WINTER

WINTER BROTHERS COMPANY

Rochester, Michigan, U.S.A. Distributors in principal cities

Branches in New York • Detroit • Chicago • Dallas • San Francisco • Los Angeles

A Division of National Twist Drill & Tool Co.

Cutting Edges That
Cut Costs
Once you start using National Tools—whether for roughing or finishing, for production or for accuracy—you'll stay with them. Their fine cutting edges give you the better work that cuts your costs.
NATIONAL TWIST DRILL AND TOOL COMPANY
Rochester, Michigan, U.S.A.
Distributors in principal cities.
Factory branches—New York • Detroit
Chicago • Dallas • San Francisco
Los Angeles
CALL YOUR INDUSTRIAL SUPPLY DISTRIBUTOR for all your staple industrial needs, including NATIONAL Twist Drills, Reamers, Counterbores, Milling Cutters, End Mills, Hobs and Special Tools.
NATIONAL
TWIST DRILL
& TOOL
ROCHESTER, MICH., U.S.A.
National

HERE'S WHY LODGE & SHIPLEY BEDS and WAYS ARE STRONG and LONG LASTING

Maintenance men find it easy not to work up a sweat over Lodge & Shipley Beds and Ways. And there are many reasons why:

REPLACEABLE

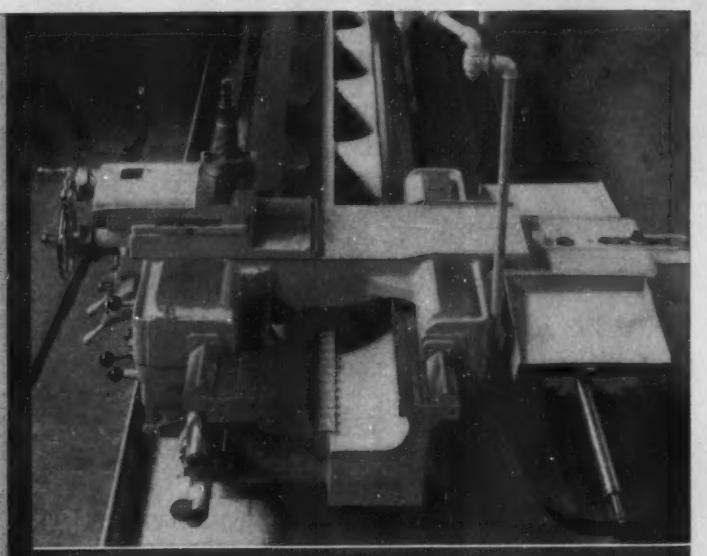
bedways are completely machined and then assembled to the bed. If damaged, they can be replaced in the field, eliminating factory rebuilding.

BED

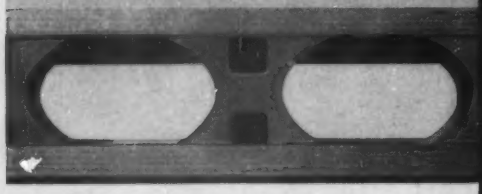
. . . exclusive elliptical girth design gives greatest possible resistance to twisting as well as to horizontal or vertical deflection.

WAYS

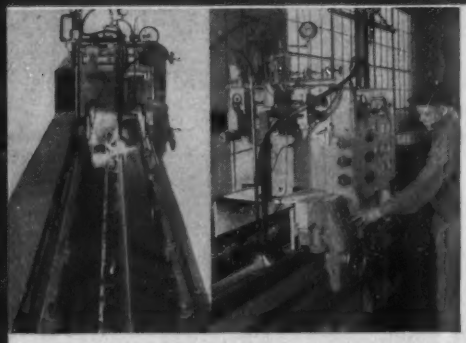
. . . special steel, automatically flame hardened and quenched, then Sub-Zero treated and drawn to Rockwell 60$_c$ hardness . . . virtually wear-proofed!



Replaceable ways eliminate shortcomings of integral ways.



Elliptical girth bed design proved strongest known.



Automatic hardening and quenching for minimum Rockwell 60$_c$ hardness.

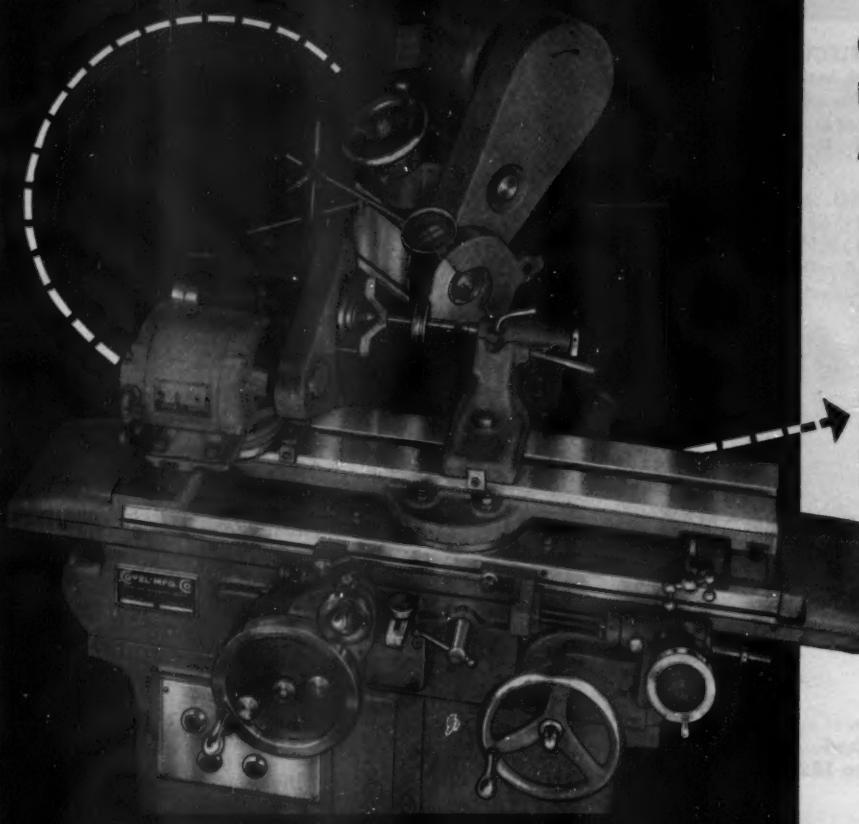
"Deep freezing" makes steel structure stronger, more uniform, and tougher.

These are just a few of many Lodge & Shipley lathe features. If you'd like more information . . . proof that a Lodge & Shipley Lathe is your "Lodg-ical" choice, write for "features" Bulletin No. 200.

THE **Lodge & Shipley** COMPANY

3055 COLERAIN AVE., CINCINNATI 25, OHIO

. . . . your **LODGE-ical** *choice!*



COVEL NO. 12 UNIVERSAL CUTTER AND TOOL GRINDER

This versatile machine can get production off to a flying start — and keep pace with a steady flow of precision-ground, highly efficient tools.

Typical of No. 12's *universal* scope is this form grinding attachment set-up for grinding circular form tools. It embodies fine longitudinal feed—fine cross feed; for the extreme accuracy necessary for both longitudinal and transverse movement.

Write for
12-page detailed
Bulletin AM-224

PRODUCTION *Starts* IN THE TOOL ROOM

Look to your tool room — where production starts — and see whether your tool-makers and set-up men are hampered by obsolete, inaccurate and wasteful grinding equipment. Poorly ground tools and cutters handicap production every step of the way — through inferior results, costly rejects, loss of valuable time, expensive tool waste.

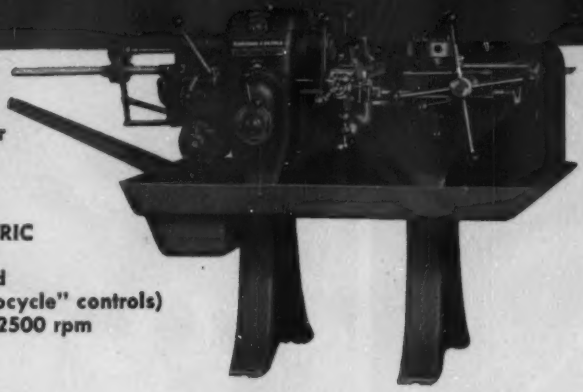
If your cutter and tool costs are high, perhaps you are *paying* for Covel quality without enjoying its many profit-saving advantages . . . and if so, now is the time to call on Covel for the answer. We will be pleased to send complete information.

80 YEARS of continuous manufacturing experience makes your COVEL choice a sound one.

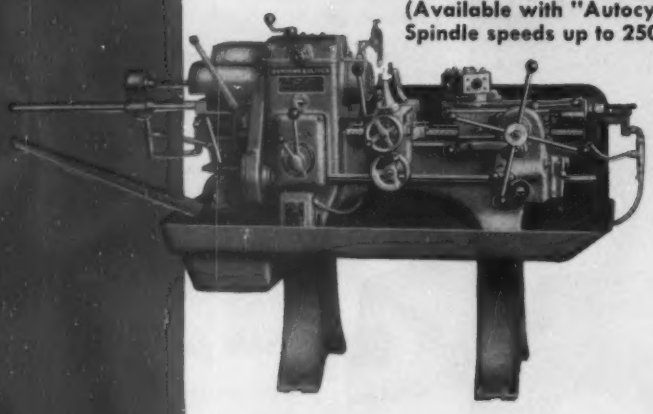
COVEL PRECISION GRINDERS
BENTON HARBOR, MICHIGAN

DRILL GRINDERS • UNIVERSAL CUTTER & TOOL GRINDERS • HYDRAULIC & HAND FEED SURFACE GRINDERS

NO. 1 GEARED ELECTRIC
5/8" bar cap. with inside feed finger
13/16" bar cap. with outside feed finger
11½" swing over bed
Spindle speeds up to 3500 rpm



NO. 2 GEARED ELECTRIC
1" or 1¼" bar cap.
13½" swing over bed
(Available with "Autocycle" controls)
Spindle speeds up to 2500 rpm



A Complete Line of Turret Lathes

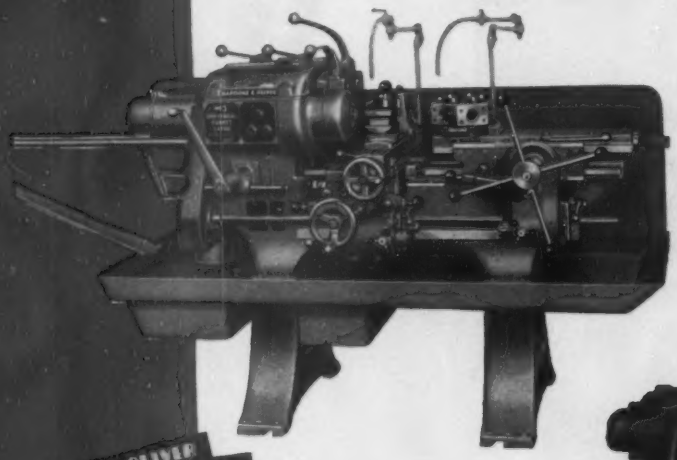
Offering

Higher Speed • More Power
Increased Rigidity • Improved Accuracy

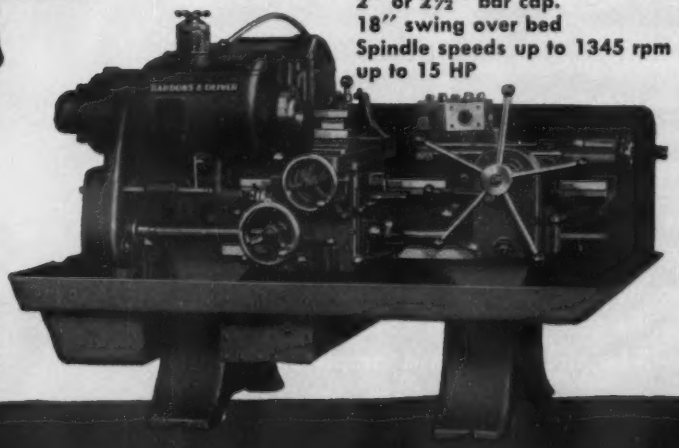
and Featuring

- **100% Anti-friction bearing, 12 speed geared headstocks**
- **Precision heat treated alloy steel headstock gears and shafts**
- **Flange type motor mounting (eliminates all belts and pulleys)**
- **Optional collet chuck capacities**
- **Solid alloy steel, replaceable bed ways on all Universal models**
- **Hardened and ground steel turret slide and saddle ways, gibs and caps**
- **Large diameter precision roller bearing turret mounting**
- **Self compensating automatic turret clamp ring**
- **Large hardened and ground-in-thread ball bearing cross slide screw with alloy bronze and anti-backlash nut on Universal models**
- **Fully enclosed, oil tight apron.**

NO. 3 UNIVERSAL
1½" or 2" bar cap.
15½" swing over bed
Spindle speeds up to 1825 rpm
up to 7½ HP



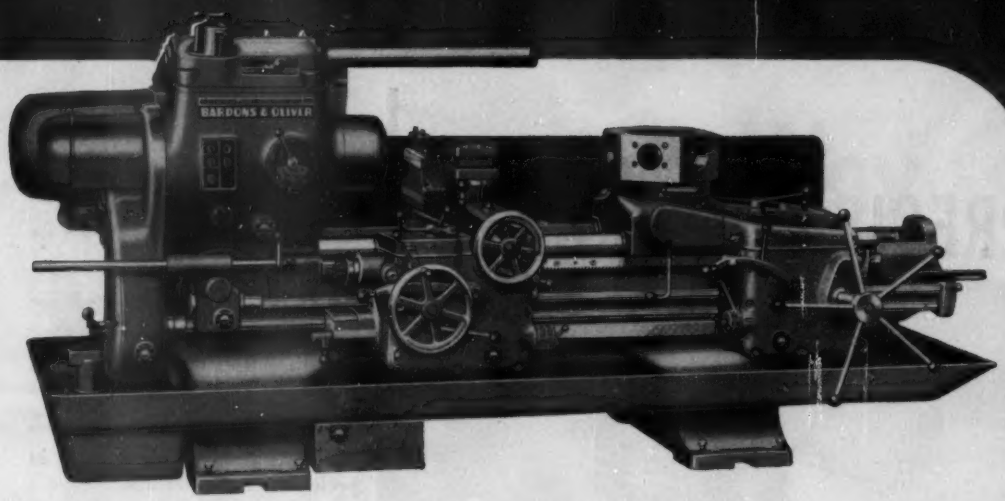
NO. 5 UNIVERSAL
2" or 2½" bar cap.
18" swing over bed
Spindle speeds up to 1345 rpm
up to 15 HP



Write for complete information, specifying size and type of work.

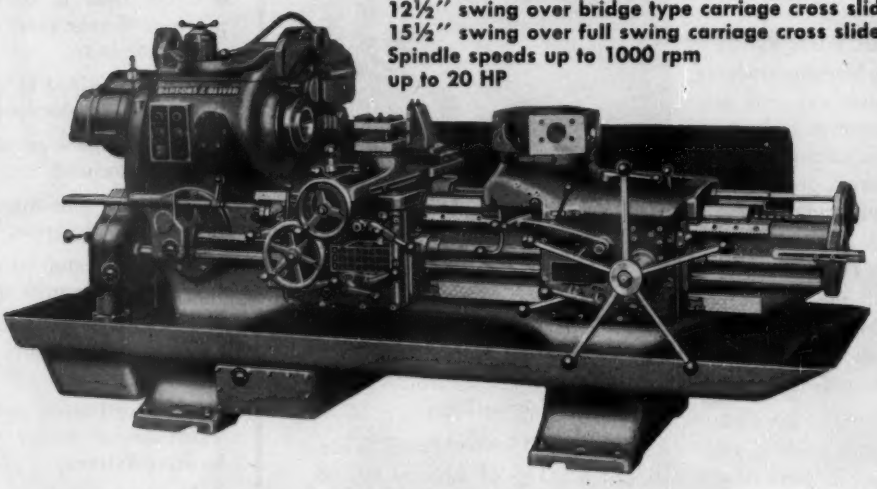
BARDONS & OLIVER, INC.

1134 WEST 9TH STREET • CLEVELAND 13, OHIO

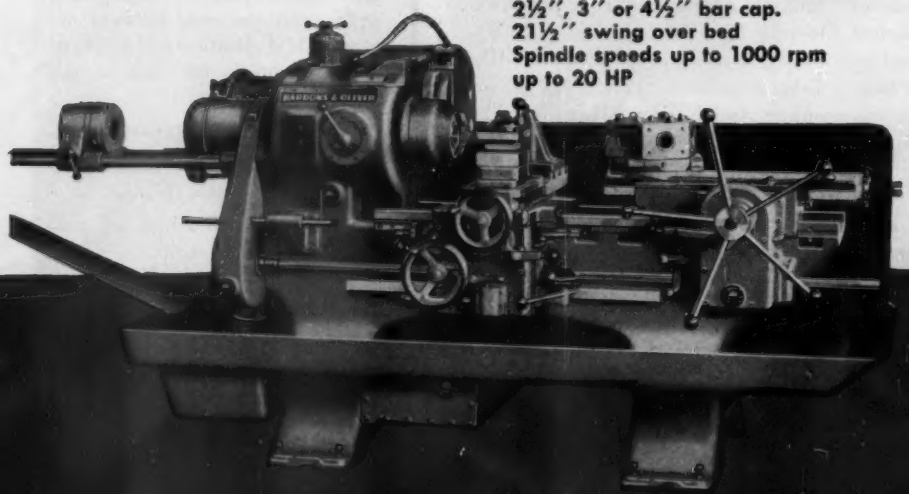


NO. 22 SADDLE TYPE
3½" or 4½" bar cap.
25¼" swing over bed
15½" swing over bridge type carriage cross slide
19" swing over full swing carriage cross slide
Spindle speeds up to 600 rpm
up to 30 HP

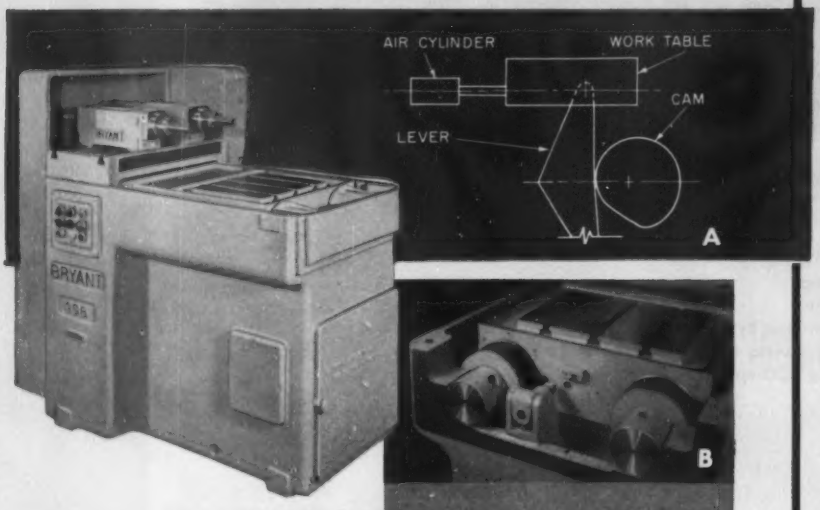
NO. 21 SADDLE TYPE
2½", 3" or 4½" bar cap.
21¼" swing over bed
12½" swing over bridge type carriage cross slide
15½" swing over full swing carriage cross slide
Spindle speeds up to 1000 rpm
up to 20 HP



NO. 7 UNIVERSAL
2½", 3" or 4½" bar cap.
21½" swing over bed
Spindle speeds up to 1000 rpm
up to 20 HP



...PRECISION BORING



HIGHER PRODUCTION RATES—This Bryant Boring Machine produces uniform fine finishes—at peak production rates. It assures highest repetitive accuracy in precision boring, drilling, turning, facing, grooving and contour boring and turning.

The table is actuated by a simple cam and lever unit **A** which provides positive control of the cycle at all times. This mechanical actuation eliminates variation in the cycle due to temperature change.

FINER FINISHES—The Bryant 998 provides the smooth, uniform table motion so essential in generating a fine finish with a single point tool. The table moves on two 4" diameter solid steel slide bars **B** firmly bolted to the bed. The table is supported by two anti-friction preloaded ball bearings on each of these bars. This construction provides a metal-to-metal contact which eliminates shifting due to an oil film **C**.

MINIMUM DOWN-TIME—The Bryant 998 requires minimum servicing—motors, boring heads and slides are permanently grease sealed. Every unit is easily accessible.

SPECIFICATIONS—Total table stroke: 6"; Top of table to top of bridge: 4"; Width of bridge: 27⅜"; Multiple boring heads as required by tooling to a maximum of 4 (209) heads; Boring head motor: 5HP; Table dimensions: 17½" x 22"; Floor space (without coolant tank): 31" x 54".

20 REASONS WHY...

- Bed, bridge, table and heads are normalized Meehanite castings.
- Cam actuated table moves on preloaded ball slide bars.
- Cam is hardened and ground.
- Boring head spindles rotate in preloaded ball bearings.
- Air cylinder opposes the work table motion directly with constant pressure and keeps the cam follower roll and the cam always in contact.
- Boring head drive is completely accessible.
- Cam drive assembly is protected by a torque limiting clutch.
- Cycle time is controlled by precision change gears in the cam drive gear box.
- Pad is provided at the rear for mounting accessory equipment.
- Push button controls are conveniently located.
- Manual, semi-automatic or fully automatic cycle.
- Emergency stop button instantaneously interrupts the cycle.
- Jog buttons on both front and rear of the machine for setup purposes.
- Machined setup pads are provided on the bridge for ease in locating fixtures.
- Maintenance is necessary at only three points: two grease fittings on the cam follower assembly and cleaning and filling of the filter-lubricator unit in the pneumatic system.
- Ball slide table is grease sealed.
- Gear box has its own closed lubrication system.
- Boring head bearings are permanently grease sealed.
- Cam is easily accessible for changing the table stroke.
- Change gears are enclosed in their own wet sump, splash lubrication system.

Write today for complete details!

BRYANT Chucking Grinder Co.

SPRINGFIELD, VERMONT, U. S. A.

Offices: Indianapolis • Cleveland • Chicago • Detroit • Mt. Vernon, N. Y. • Philadelphia

Internal Grinders • Boring Machines

Internal & External Thread Gages • Granite Surface Plates

Johnson's Wax Metalworking Lubricants

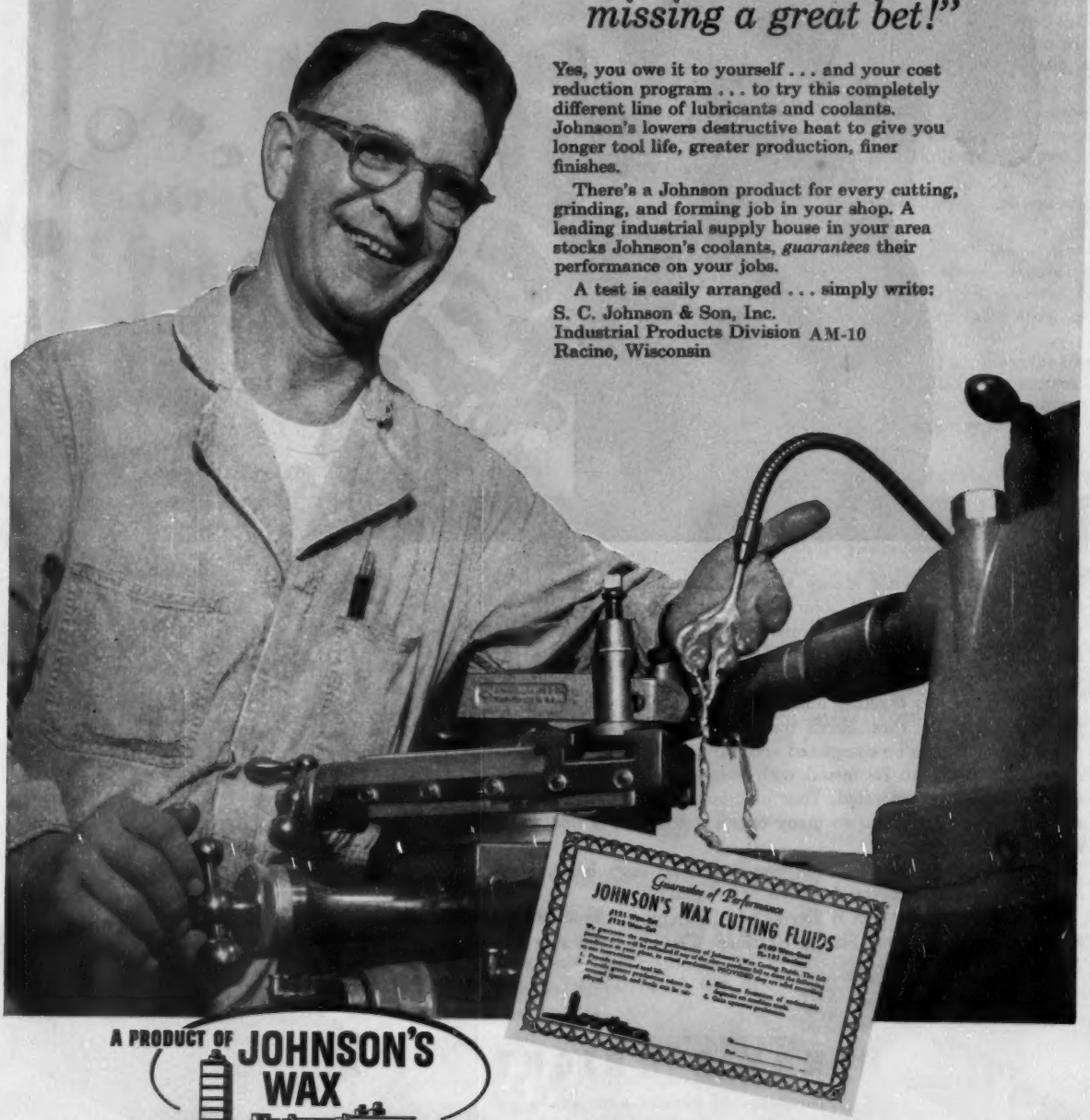
"If YOU haven't tried Johnson's, you're missing a great bet!"

Yes, you owe it to yourself . . . and your cost reduction program . . . to try this completely different line of lubricants and coolants. Johnson's lowers destructive heat to give you longer tool life, greater production, finer finishes.

There's a Johnson product for every cutting, grinding, and forming job in your shop. A leading industrial supply house in your area stocks Johnson's coolants, *guarantees* their performance on your jobs.

A test is easily arranged . . . simply write:

S. C. Johnson & Son, Inc.
Industrial Products Division AM-10
Racine, Wisconsin



A PRODUCT OF JOHNSON'S WAX

All products of Johnson's Wax . . . Wax-Cool . . . TL-131 . . . Wax-Cut . . . Wax-Draw . . . Stik-Wax

smooth, direct parts flow

for short or long runs

Because of its superior ability to take off center die loads, the Henry & Wright Dieing Machine widens the ways in which you can use the economies of progressive stamping. Add to this basic advantage the accessibility of the H & W Dieing Machine for quick die changes.

Now tie the two together and you have a high speed, low cost production method that affords the maximum degree of flexibility in tooling. Jobs can be completed according to the toughest schedules. Short runs can be mixed with long runs. Assembly tooling can be readily incorporated. Your planning becomes a direct and simple matter of figuring so many completed parts per minute or hour per machine.

Most important, too: you cut your stamping costs below your best expectations and you improve parts quality.

Get the facts about H & W Dieing Machines by writing to Henry & Wright, 481 Windsor Street, Hartford, Conn., for Catalog 54.

HENRY & WRIGHT

DIVISION OF EMHART MFG. CO.

HARTFORD, CONNECTICUT

PRATT & WHITNEY

KELLERFLEX

SERIES "M" FLEXIBLE SHAFT MACHINES

BY FAR THE FINEST . . . FOR FAST, LOW-COST FINISHING

EASY SPEED CHANGES

. . . by depressing the spring-suspended jackshaft and shifting belts . . . and by re-arranging the jackshaft sheaves . . . no tools required.

RUGGED . . . for constant, heavy-duty use.

VERSATILE . . . 16 speeds (increased to 32 by high speed attachment) and a wide choice of attachments to handle an almost unlimited variety of jobs.

PRECISION BUILT . . . to insure smoother, more accurate performance and longer life, with substantially reduced maintenance costs.

POWERFUL . . . ¼ to 1 hp . . . all you need for any job.

FAST . . . speeds to 24,000 rpm . . . *only* machines with *proved* performance at speeds over 10,000 rpm, essential for fully efficient use of fast-cutting carbide burs.

ALL-PURPOSE MOUNT . . . using the tray, the Series "M" Machine becomes a bench model; using the eye-bolt, it becomes a suspension type.

The leading manufacturer of flexible shaft machines for over twenty-five years, Pratt & Whitney is the oldest in the field. This long experience is reflected in the Kellerflex. Not only the machine . . . but also its attachments, handpieces and cables . . . are universally recognized as the finest ever produced. In hundreds of plants throughout the country Kellerflex Machines are helping to speed up production, reduce costs and improve quality . . . and they can do the same for you.

SEND NOW FOR FULL INFORMATION

Write on your Company letterhead for complete information. Data on all attachments and accessories is included.

PRATT & WHITNEY
DIVISION NILES-BEMENT-POND COMPANY
WEST HARTFORD 1, CONNECTICUT, U.S.A.
SINCE 1860

First Choice for Accuracy

BRANCH OFFICES: . . . BIRMINGHAM • BOSTON • CHICAGO • CINCINNATI • CLEVELAND • DALLAS (The Bruce Co.) • DETROIT • HOUSTON (The Bruce Co.) LOS ANGELES • NEW YORK • PHILADELPHIA • PITTSBURGH • ROCHESTER • SAN FRANCISCO • ST. LOUIS • EXPORT DEPT., WEST HARTFORD

MACHINE TOOLS • CUTTING TOOLS • GAGES

Main lever of 24" Industrial Shaper. Gould & Eberhardt, Inc., Irvington 11, New Jersey.

Photographs courtesy of Gould & Eberhardt, Inc., Irvington 11, New Jersey.

"improved quality"

This exacting job at Gould & Eberhardt, Inc. calls for drilling, boring, reaming and facing one $2\frac{3}{16}$" hole and one $1\frac{11}{16}$" hole. Holes must be parallel with each other and square with the ways within .0015" per foot. Diameters are held to ±.0003". This Cincinnati Bickford Super Service Radial Drill brought improved quality in production.

Write for catalog R-29.

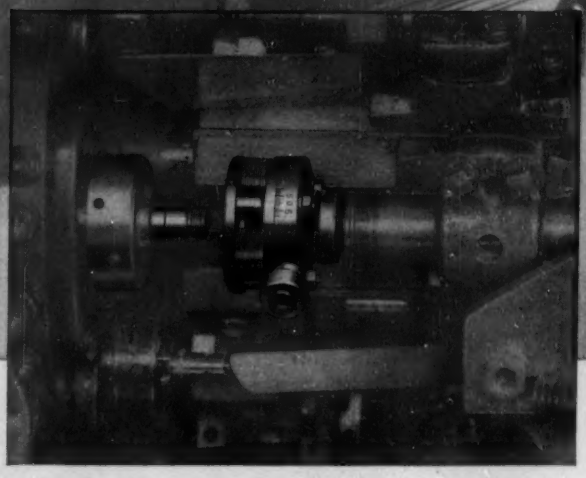
CINCINNATI BICKFORD

RADIAL AND UPRIGHT DRILLING MACHINES

THE CINCINNATI BICKFORD TOOL CO.

Cincinnati 9, Ohio, U.S.A.

3¼ miles of *rolled* threads...



Style F-2 non-revolving type National Acme "FETTE" thread rolling head on end ring setup on 9/16" RA-6 Acme-Gridley Bar automatic

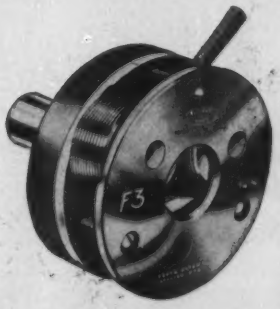
and the National Acme "FETTE" thread rolls are still going strong

Piece after piece—at the rate of 1500 an hour—these brass end rings roll off a 9/16" RA-6 Acme-Gridley automatic. And with more than 627,000 pieces in the bin, the National Acme "FETTE" head is still rolling identical threads with the same set of rolls.

You don't have to figure it out. When you use these self-opening thread rolling heads you *know:*

- **threading speeds will be the same as high speed steel turning tool speeds**
- **threads will be more accurate, stronger and smoother by this "cold-forming" rolled thread process**
- **trouble-free performance of National Acme "FETTE" heads means uninterrupted production—less down time**
- **more "mileage" with a set of rolls means lower cost per piece**

Check the advantages of FETTE heads for your threading jobs—send sample or print for our recommendations, or ask our representative to call.



National Acme "FETTE" Self-opening Thread Rolling Heads are used on automatics, turret or hand lathes, threading machines, drill presses, and other types of vertical and horizontal machines.

Design simplicity and rugged construction insures long life of head and rolls. Made in revolving type in capacities 7/16" to 1"; non-revolving type 1/16 to 3/4".

Ask for Catalog FRH-53

The NATIONAL ACME COMPANY

170 EAST 131st STREET • CLEVELAND 8, OHIO

Acme-Gridley Bar and Chucking Automatics 1-4-6 and 8 Spindle Hydraulic Thread Rolling Machines • Automatic Threading Dies and Taps • Limit, Motor Starter and Control Station Switches • Solenoids • Contract Manufacturing.

Removable block gap

3 swing sizes: 16″/27″ 20″/30″ and 25″/40″. Removable block gives additional swing capacity within the gap.

Extension bed gap

2 swing sizes: 20″/40″ and 28″/50″. Wide, deep adjustable gap makes these lathes doubly useful.

Engine

6 swing sizes: 16″, 20″, 25″, 27″, 32″ and 36″. Now built with more speed, power, accuracy and capacity.

Only Nebel gives you the unbeatable combination of dependability and economy. For complete information on the size and type of Nebel lathe best suited to your requirements, write today for descriptive bulletin.

Odd shaped jobs . . .

are easily, accurately and profitably handled in the wide, deep gap of Nebel removable block gap lathes (above) and extension bed gap lathes. And if your requirements call for engine lathes, you'll be ahead to check Nebel for these, too. Swing sizes 16″ to 50″. There's a size and type for all your requirements. Phone us today for complete information.

Nebel
LATHES
CINCINNATI

WHEN THREADS HAVE TO BE

Right

..Your gages do too!

Detroit thread plug and thread ring gages have long been noted for their high degree of accuracy and long life.

Now, in addition to accuracy and quality, Detroit Tap and Tool can make prompt delivery on Standard American National thread gages as well as on gages for Unified threads, American Standard pipe threads, Aeronautical pipe threads or Dryseal pipe threads.

Many special size thread ring and thread plug gages are also carried in stock for immediate shipment.

See your local Detroit Tap and Tool representative today. Ask for our complete Catalog-Price List (SG-53) covering standard thread gages.

DETROIT TAP & TOOL CO.

8615 E. EIGHT MILE RD. BASELINE, MICHIGAN

GOING UP...
Electric Motor

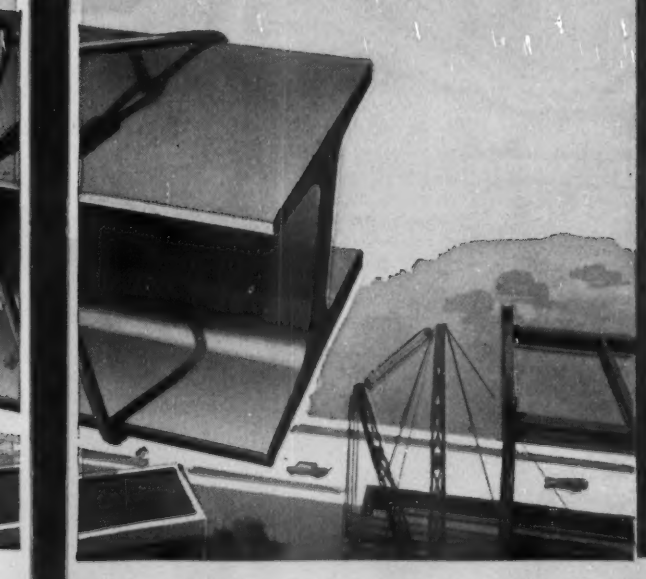
Performance!

To a towering structure of design achievement Fairbanks-Morse adds still another outstanding member . . . a compact new enclosed motor . . . backed by an engineering tradition which has been a-building for more than a century.

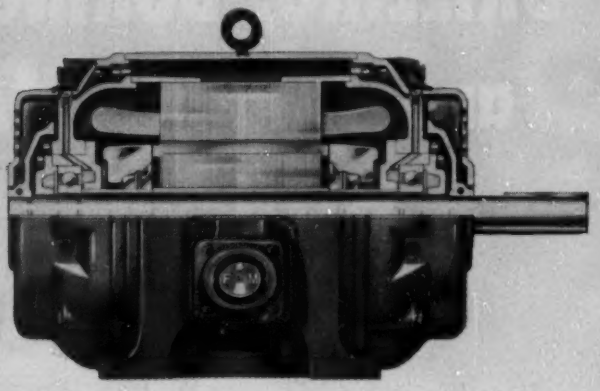
That tradition is
More Performance in Less Space.

You, as a buyer of electric motors, will benefit by that tradition . . . just as the users of Fairbanks-Morse diesel engines, pumps, scales, locomotives and the many other F-M products are today enjoying the advantages of finer performance.

Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago 5, Illinois.



NEW FAIRBANKS-MORSE
TOTALLY ENCLOSED FAN-COOLED MOTORS



TOTALLY ENCLOSED—Wherever adverse operating conditions are encountered, F-M totally enclosed construction effectively insures electrical parts and bearings against contamination by dirt, abrasive dusts, metal particles, corrosive gases and steam.

DOUBLE-END VENTILATION—Cooling air is drawn through guarded openings in both fan shields and uniformly circulated through cored passages surrounding the sealed inner shell. Efficient heat-transfer action insures uniform internal cooling. Exhaust air is discharged through bottom of frame—not across motor and driven machine.

COPPERSPUN ROTOR—Exclusive Fairbanks-Morse feature—an indestructible one-piece rotor—homogeneous, free from flaws for maximum strength and lifetime service.

CONDUIT BOX—New, gasketed, cast iron conduit box permits easy pulling of cables without insulation damage. Fairbanks-Morse exclusive: recess feature allows elimination of conduit box where space is limited.

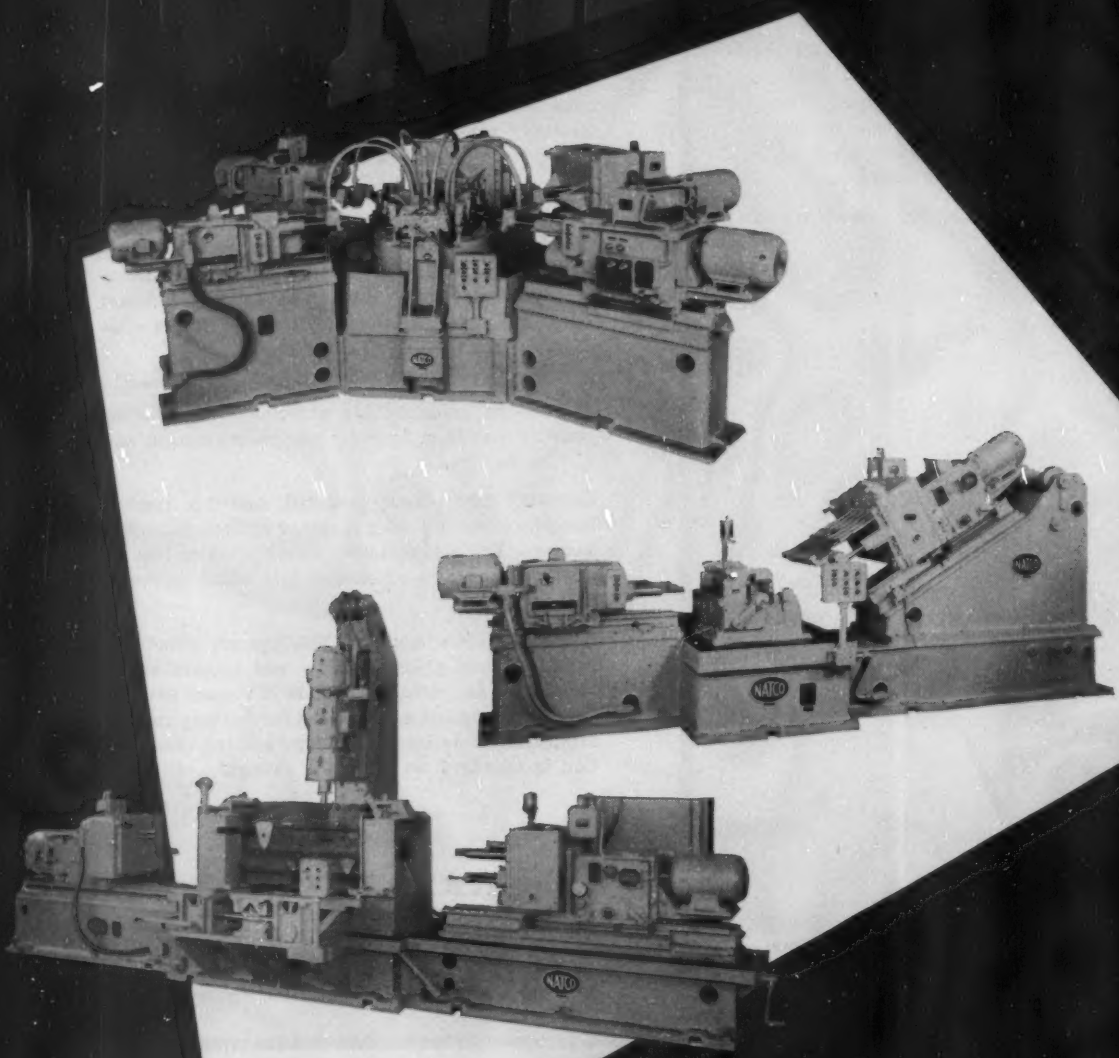
BEARINGS—Precision ball bearings are effectively sealed against grease leakage and contain ample lubrication for extended periods of rugged service. Convenient means are provided for flushing and relubricating if desired. Cartridge bearing construction is standard on all larger ratings.

FAIRBANKS-MORSE
a name worth remembering when you want the best

ELECTRIC MOTORS AND GENERATORS • DIESEL LOCOMOTIVES AND ENGINES • PUMPS • SCALES • RAIL CARS • HOME WATER SERVICE EQUIPMENT • FARM MACHINERY • MAGNETOS

BUILD YOUR OWN DRILLING, BORING, FACING and TAPPING MACHINES WITH...

NATCO



Shown at left are a few representative machines that have been built from NATCO Holeunits. These standard, compact, self-contained hydraulic units are furnished in three sizes and may be arranged with any one of seven different horsepower capacities ranging from one and one-half to fifteen horsepower. They will operate at any angle and no connections other than electrical are required.

Call a Natco Field Engineer

to help you solve your problems in
Drilling, Boring, Facing and Tapping

NATCO

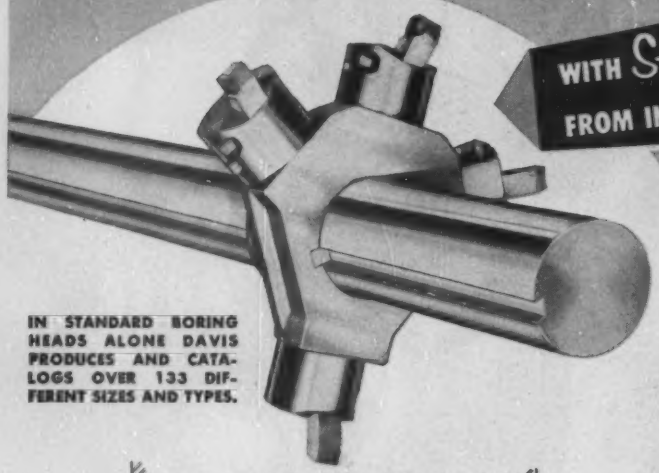
NATIONAL AUTOMATIC TOOL COMPANY, INC., Richmond, Indiana

Branch Offices

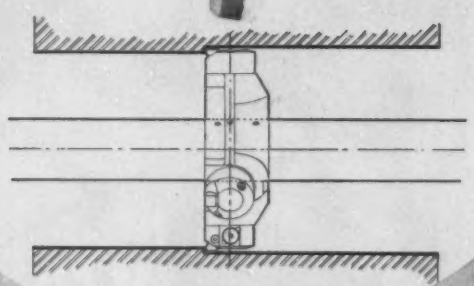
CHICAGO, Room 203, 6429 W. North Ave., Oak Park • DETROIT, 10138 W. McNichols Rd.
BUFFALO, 1807 Elmwood Ave. • NEW YORK, 35 Beechwood Ave., Mount Vernon

Let DAVIS cut your Boring Costs 2 ways

WITH Standard Tooling ITEMS FROM INDUSTRY'S MOST COMPLETE LINE



IN STANDARD BORING HEADS ALONE DAVIS PRODUCES AND CATALOGS OVER 133 DIFFERENT SIZES AND TYPES.



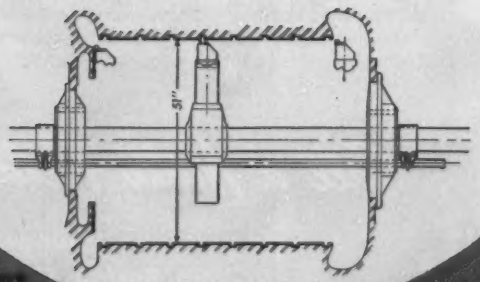
Every boring job in your shop... regardless of range, material or complexity... can be done faster, cheaper and with greater precision, when you make Davis your tooling headquarters. That's because only Davis has both the complete line and broad machining experience to supply or design exactly the right tool for your work.

Davis tooling specialists help you immeasurably in selecting the right tool from industry's broadest standard line. Their unrivalled background of practical shop experience assures recommendations that exactly meet all your requirements for tolerances, finish, speeds, feeds and maximum tool life at minimum cost.

TYPICAL OF DAVIS SPECIAL TOOL DESIGNS IS THIS EXTENSION BORING HEAD WHICH BORES, FACES AND GROOVES A 51" DIAMETER HOLE.

WITH Job-Engineered SPECIALS FROM INDUSTRY'S FOREMOST DESIGNERS

Where work is beyond the scope of standard tools or where efficiency can be improved or costs reduced by combined operations, special fixturing, etc., the specialists in Davis Engineered Tooling Service will work with you in developing tools for even the most complex application. Consult your local Davis field engineer or send us complete work details for impartial recommendations.



DAVIS
BORING TOOL DIVISION
of Giddings & Lewis Machine Tool Company
Fond du Lac, Wisconsin

THE ONE NAME THAT CERTIFIES ULTIMATE PRECISION AND PRODUCTIVITY IN TOOLING

at one of the world's largest automotive plants 37¼ seconds for 28 operations

JOB FACTS:

PART.....Torque Impeller Hub.
SIZE.....4" diam. 1¼" long.
MATERIAL.....Steel forging, SAE 1146 annealed
MACHINES: 6 inch model RPA-8 Acme-Gridley Chucking Automatics.

1ST MACHINE, with double index and duplicate tooling finishes 2 pieces per cycle—each with 11 identical operations. All carbide tooled.

Machine Time: 22½ seconds—320 per hour.

2ND MACHINE, single index with one set of tools completes opposite side to 17 operations. All carbide tooled.

Machine Time: 26 seconds—138 per hour.

WITH 100% CARBIDE TOOLING ON 8-SPINDLE Acme-Gridley Chucking Automatics

IN this most competitive big business all planning must be toward higher consumer acceptance in both quality and purchase price—and leave a profit for the effort.

All three of these prime essentials begin with small parts such as these and hundreds of others made on multiple spindle chucking automatics.

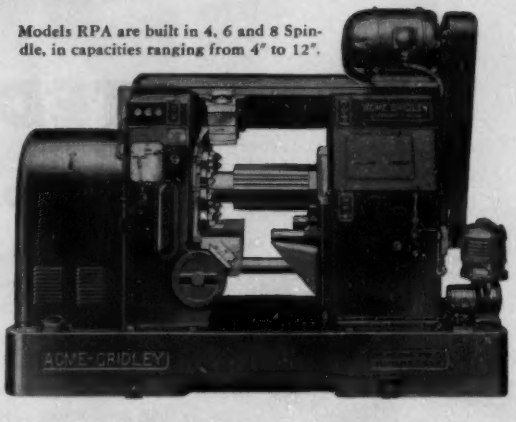
Alert, continuous and critical study is given to the most minute detail for manufacturing improvements, accepting only those which will:

- **save a fractional second in time per piece**
- **avoid rehandling on extra machines**
- **release valuable floor space**
- **relieve costly man-hours for other work**

—all to the end of achieving better components at lowered factory cost.

For more than 20 years Acme-Gridley machine design engineers and tooling specialists have helped meet these vital needs—by improving basic machine stamina, by ingenious applications of fastest cutting carbide tools, by simplifying operator effort. All of which applies to multiple chucking operations and to bar machine performance.

Models RPA are built in 4, 6 and 8 Spindle, in capacities ranging from 4" to 12".



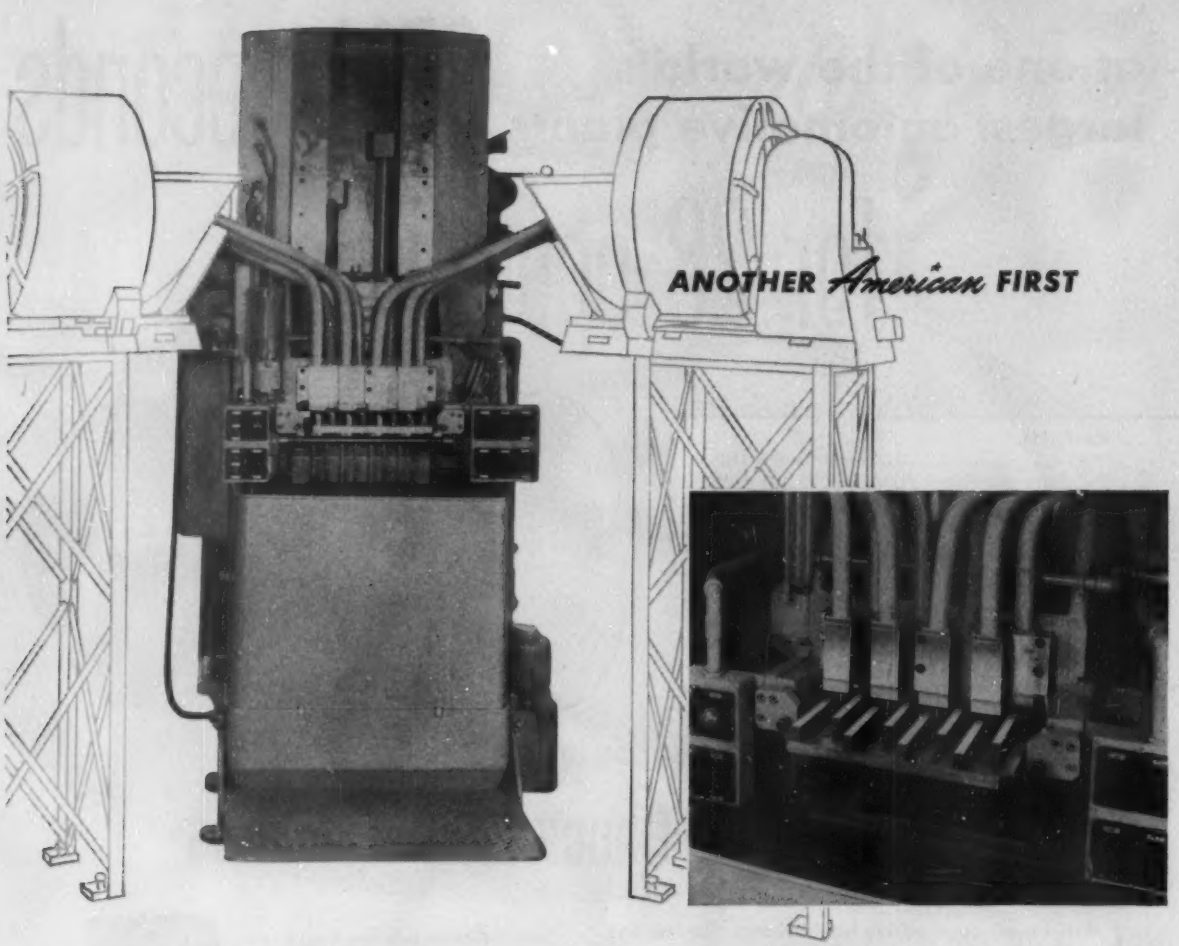
Regardless of the particular kind of mass production parts, let us show you how to put Acme-Gridleys to work in your plant—MORE PROFITABLY.

Remember—your market also must be protected against competition if you expect to make a profit.

The NATIONAL ACME COMPANY

170 EAST 131st STREET • CLEVELAND 8, OHIO

ACME-GRIDLEY BAR and CHUCKING AUTOMATICS
1-4-6 and 8 Spindle • Hydraulic Thread Rolling Machines • Automatic Threading Dies and Taps • Limit, Motor Starter and Control Station Switches • Solenoids • Contract Manufacturing



AUTOMATED BROACHING

1600 piston pins per hour

As a metal working process, broaching adapts easily to the new concept of automation — with new highs in productive capacity achieved in a great variety of different applications.

Here, an eight station American vertical pull-up broaching machine, equipped with hopper feeds and hydraulic positioning slide, automatically broaches the ID of automotive piston pins — eight at a time, 1600 per hour. Feed, broaching and parts ejection continue automatically once the machine cycle has been started.

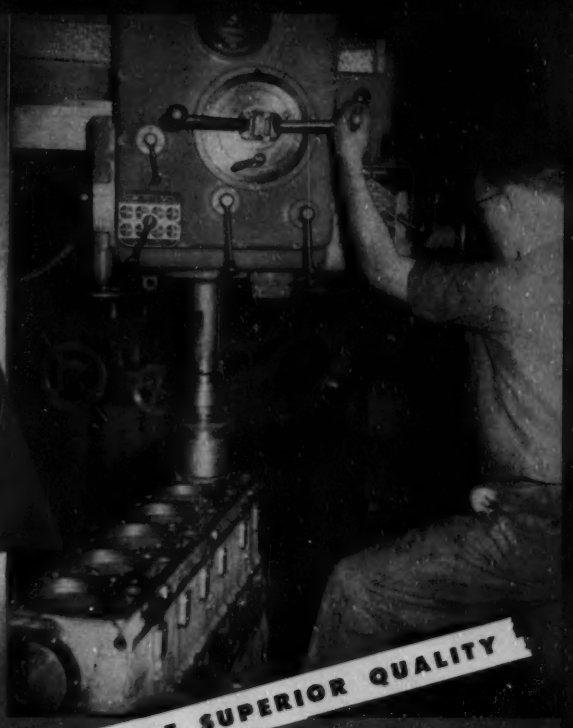
Why not investigate the all-around service that American is equipped to give you on broaches, fixtures and broaching machines. Drop us a line, giving details of your machining problem — catalogs and recommendations will be furnished promptly.

AMERICAN *American* BROACH & MACHINE CO.
A DIVISION OF SUNDSTRAND MACHINE TOOL CO.
ANN ARBOR, MICHIGAN

SUNDSTRAND

See *American* First — for the Best in Broaching Tools, Broaching Machines, Special Machinery

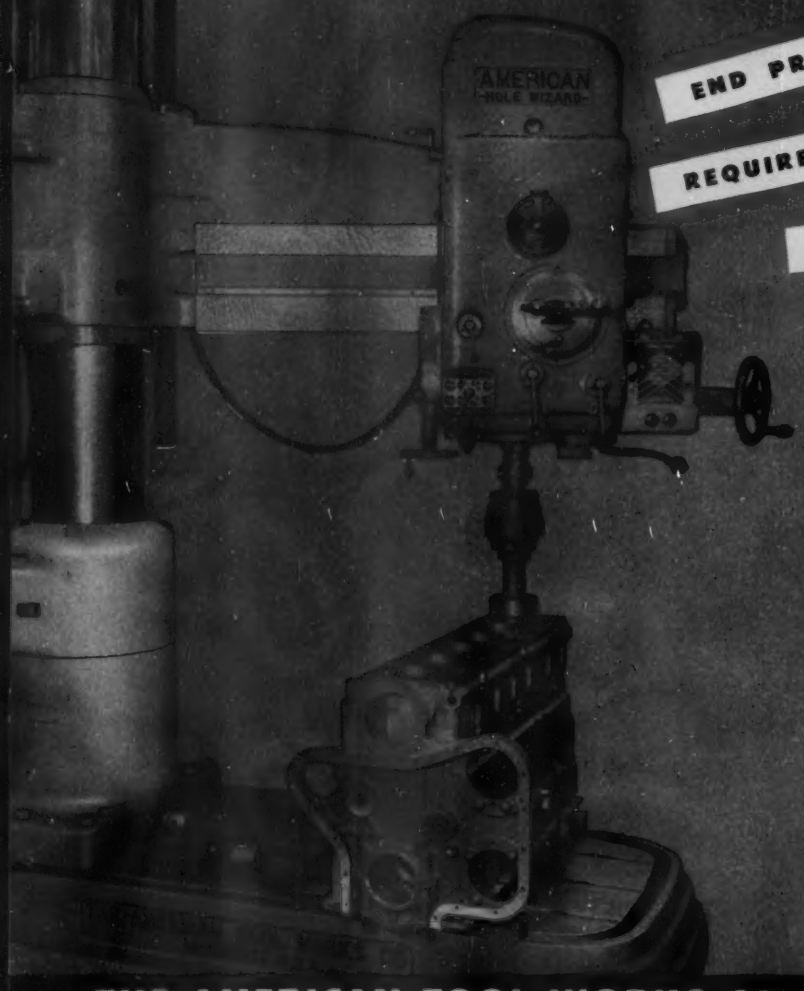
The 2 are inseparable—



END PRODUCTS OF SUPERIOR QUALITY

REQUIRE SUPER QUALITY EQUIPMENT

TO PRODUCE THEM . . .



For six years this "AMERICAN" Hole Wizard Radial has been counterboring "Cummins" Diesel Engine Blocks and holding the required depth tolerance of .001" in the 6.125" counterbores. Furthermore, the operator testifies to the fact that the machine is convenient and easy to operate and maintenance has been negligible.

The quality of "Cummins" products is universally recognized. We are proud indeed that so many "AMERICAN" Lathes and Radial Drills contribute to it.

THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

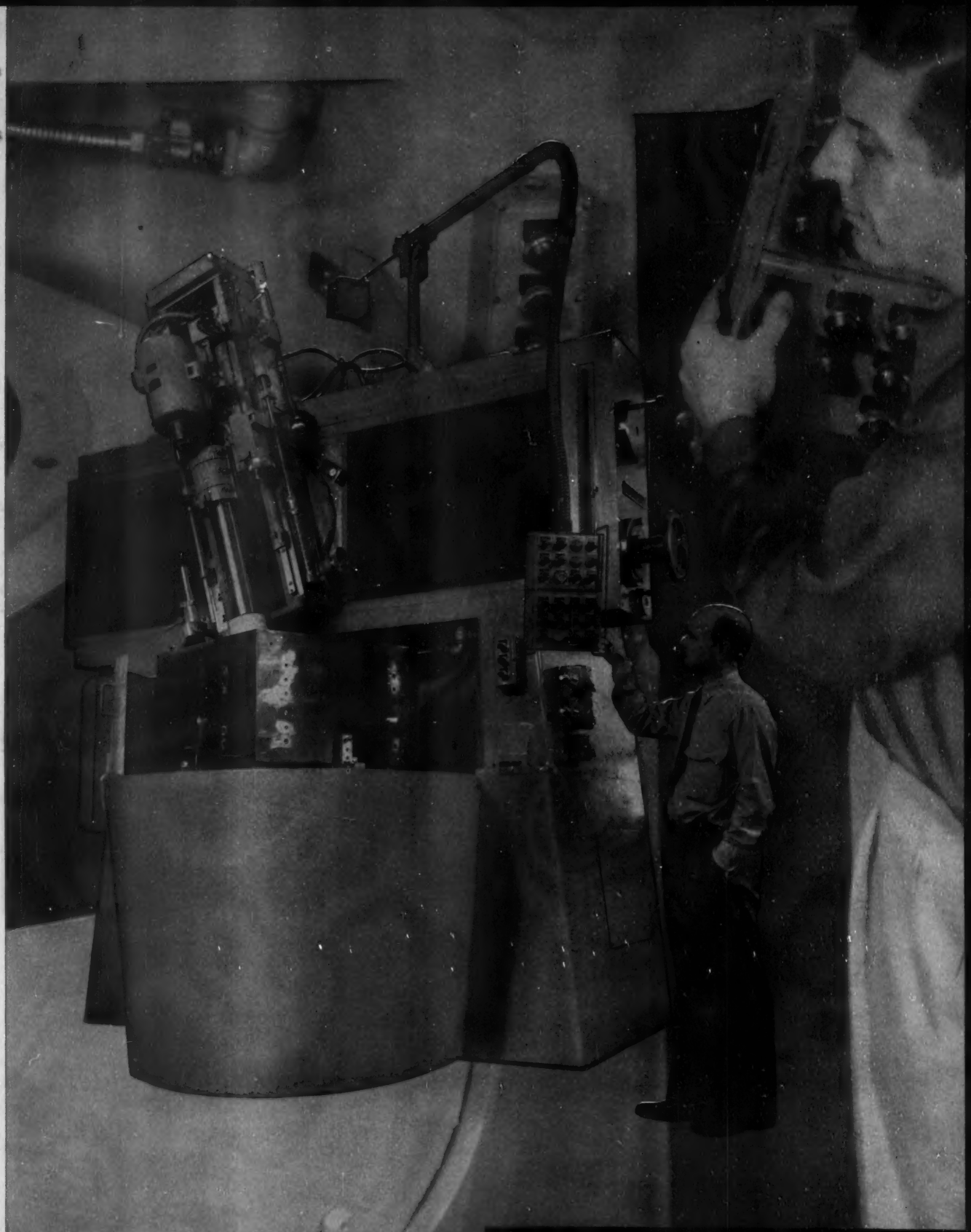
LATHES AND RADIAL DRILLS

52″ swing plus...

... plus 27½″ grinding head stroke, 24¾″ clearance over face plate, 42″ diameter face plate—on Springfield's new Vertical Universal Grinder. The work piece on the grinder here is a washing machine agitator mold, 43″ corner to corner. A tapered hole through it must match a conical male part (small illustration). One angle setting of the head ground both male and female taper for perfect fit. It had been planned to hand-lap them, a week's task. Springfield's time: 4½ hours.

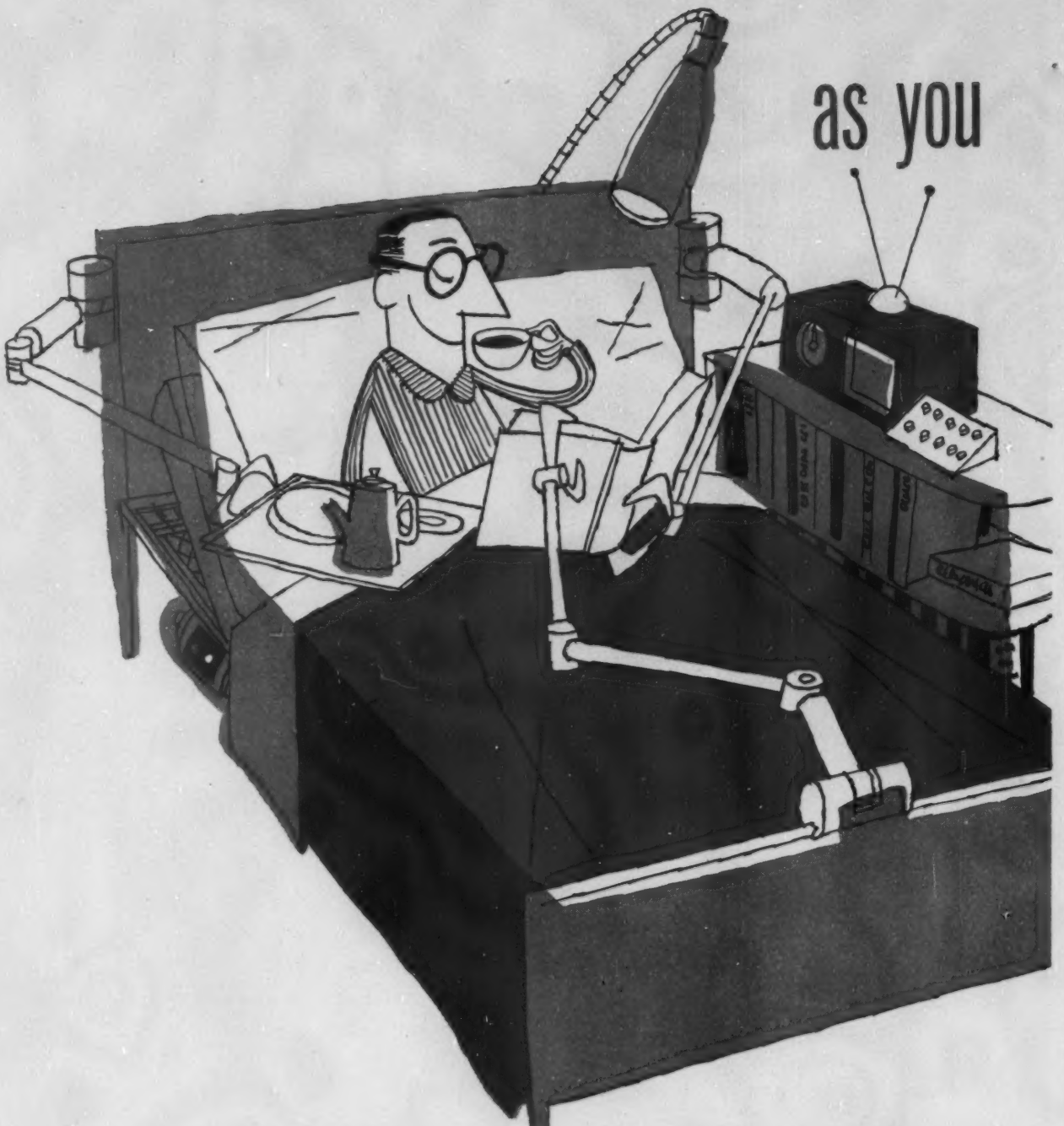
Other Springfield Vertical Universal Grinders—swings 21″ and 30″.
Lathes—toolroom, engine, contouring, reproducing—14″ to 32″.
Write for name of nearest Springfield dealer.

67TH YEAR OF BUILDING IDEAS INTO MACHINE TOOLS



THE SPRINGFIELD MACHINE TOOL CO., SPRINGFIELD, OHIO

SPRINGFIELD



put the power of Metalworking's great sales builder . . . .

make your bed, so you must lie in it

The same is true of *every* business, including the publishing of a metalworking magazine. And although a number of metalworking magazines attempt to serve all major functional groups in this giant industry, *American Machinist* long ago set out to make itself just one thing: the most useful of all magazines to Metalworking's *production engineers and executives.* The results have always been good to live with . . . and never better than now.

By concentrating its editorial pages 100% on the interests and problems of Metalworking's most influential buying group, *American Machinist* has become the most important editorial *and* advertising force in this $95-billion industry.

American Machinist's 34,000 paid subscribers make up the *biggest* subscriber audience in the history of metalworking magazines. And because this *biggest* paid circulation is *highly concentrated* among production-responsible engineers and executives, advertisers to Metalworking have long found *American Machinist* the most resultful of metalworking media. Currently, over 950 suppliers of the products used and bought by Metalworking invest far more advertising pages and dollars in *American Machinist* than in any other metalworking publication.

Thus, when *you* want a bigger share of the huge metalworking market, it makes sound, sales-wise sense to put *American Machinist* at the top of your advertising schedule. *All* the reasons why are quickly available from your nearest *American Machinist* representative.

Just Out!
The complete facts about
THE METALWORKING MARKET
what it is—where it is—who buys your products
—how you sell them best through advertising.
52 pages of helpful facts and figures for every company and agency selling to Metalworking. Ask, or write, for your free copy today

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THE McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION
McGRAW-HILL BUILDING, NEW YORK 36
PUBLISHED EVERY OTHER MONDAY
MEMBER OF THE AUDIT BUREAU OF CIRCULATIONS
AND ASSOCIATED BUSINESS PUBLICATIONS

National Tool Co.

Years of successful experience in special tooling and related production problems are yours for the asking. When the job requires special cutting tools call in your National Tool Co. representative. He is backed by more than 49 years experience in the engineering and manufacture of special cutting tools. His assistance is yours, without obligation, whether you're interested in one tool or a complete tooling program.

National Tools Cleveland

National
TOOL CO.
Cleveland 2, Ohio

"Here's how to get AMERICAN'S Know-How on Stainless Fasteners"

STAINLESS STEEL FASTENERS
II
Metallurgical and Engineering Report 52
Stainless Steels for Cold Headed Fasteners
Prepared by
Walton R. Yerger
Metallurgist
Herman O. Mauchinger
Director of Research
THE AMERICAN SCREW COMPANY
Willimantic, Connecticut
In recent years important developments in the field of stainless steel alloys and improved practices in the process of manufacturing fasteners have broadened the use of stainless steel in the screw products industry.
Formerly, most fasteners could be produced only from Type 410, Type 430, and Type 416 stainless steel. However, recent metallurgical progress has brought about alloys such as Type 16-chrome 18-nickel, Type 431, and Type 442, all of which have been found suitable for the cold forming of fasteners. With recent improvements in manufacturing methods, the field has been opened still further to include Type 304, Type 347, and A-286 alloys.
As manufacturing methods continue to improve and the metallurgical aspects of the alloys keep pace with the needs of industry for still better materials and fasteners, additional alloys will be put into the classification, "suitable for cold heading."
Users of fasteners have considered the advantages of stainless steel and have adopted it to replace parts previously manufactured of steel, brass, or other alloys. Certain large industries have long recognized the advantages of stainless steels and have used them to their fullest extent, as exemplified by the metal trim on automobiles, store fronts, appliances, refrigerator interior trays.
While production in stainless steel is growing by leaps and bounds, the qualitative demands for still better fasteners are being met by continued improvements as a result of the co-operation between the supplier of raw materials, the manufacturer of fasteners, and the engineers in companies using stainless steel fasteners in their assemblies. In this new field of alloy application all aspects of the fastener and the assembly must be considered. Corrosion resistance and high temperature resistance, appearance for sales appeal, physical properties such as strength and ductility, as well as over-all economic or cost consideration must be weighed with every application. Therefore, it is essential that the designer of fastener applications be well versed in this growing list of stainless steel fasteners for their selection in any particular application depends on the properties required.

This new Research Report gives sound basic guidance in the selection of standard stainless fasteners . . . lists the fundamental properties and factors to be considered in the development of any *special* stainless fastener . . . and also lists the major groups of stainless steels and the jobs to which they are best suited by their individual characteristics.

This Report is a by-product of American's unceasing research in the use of these metals and their adaptability to fastener requirements. You will find it interesting and helpful . . . and a practical basis for discussion of your problem with American engineers. Write for your copy today.

SINCE 1830

AMERICAN SCREW COMPANY

PHILLIPS HEADquarters
WILLIMANTIC, CONNECTICUT

Main Office & Plant, Willimantic, Conn.
Office & Plant, Norristown, Pa.
Office & Warehouse, Chicago, Ill.
Office, Detroit, Michigan

Two of the Steelweld Presses in action. These are Model KS-10 machines rated for 12'-0" x ⅜" steel plate. Note how Cleveland Tramrail cranes serve these presses.

Battery of STEELWELD PRESSES and SHEARS Aids Caterpillar Production

Shearing long ½-inch thick stripe into small rectangles on a Series SD-10 Steelweld. The long extension squaring arm at front facilitates this work.

THOUSANDS of tons of steel of different thicknesses are sheared and formed on Steelweld Shears and Presses into various shapes required for the large volume of tractor equipment produced at the new Joliet, Illinois, plant of Caterpillar Tractor Co. These items include scrapers, rippers, bulldozer blades and wagons.

The heavy construction of Steelweld machines and many high quality features with which they are provided make possible continuous trouble-free performance. Their design includes a number of innovations which ease operation, speed production and enable accuracy to close tolerances.

The fact that Caterpillar has bought Steelweld Shears and Presses repeatedly and now has a large battery of them is mute testimony to the satisfaction they are giving.

GET THESE BOOKS!

Catalogs No. 1010 (Presses) and No. 1011 (Shears) give construction and engineering details. Profusely illustrated.

THE CLEVELAND CRANE & ENGINEERING CO.

1450 EAST 281ST STREET, WICKLIFFE, OHIO

STEELWELD

PRESSES and SHEARS

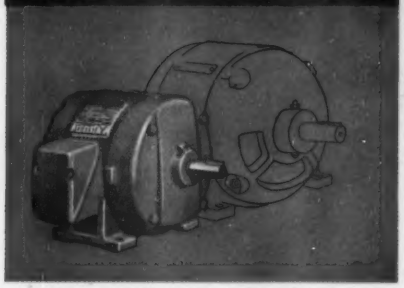
8 reasons why you should

MODERNIZE EQUIPMENT WITH TRI 55 CLAD MOTORS

REG. U.S. PAT. OFF.

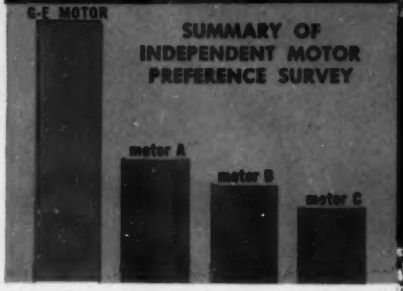
Plan now to modernize your equipment with the all-new General Electric Tri/Clad '55' motor, available now in many ratings; entire line of 1 to 30 hp a-c motors available soon. Contact your G-E Representative. General Electric Company, Section 648-6, Schenectady 5, N. Y.

MORE POWER PER POUND



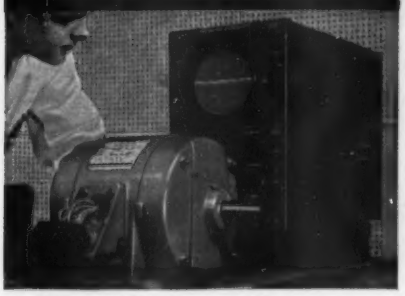
Lighter and smaller Tri/Clad '55' motors in new NEMA frame sizes and ratings save you space and weight, reduce handling costs.

BUYER PREFERENCE



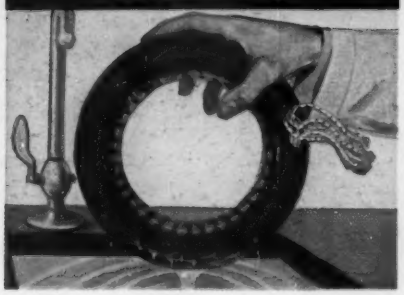
You take advantage of a 2 to 1 buyer preference for the electric motors on your equipment when you buy or specify a G-E motor.

BETTER PERFORMANCE



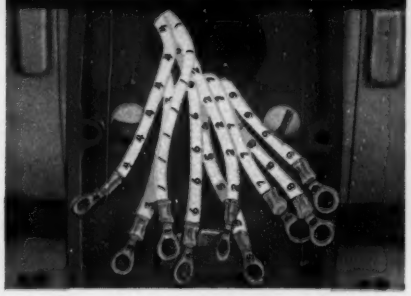
Quieter operation, proved by sound-room tests, is typical of the many performance improvements in the new G-E Tri/Clad '55'.

LONGER LIFE



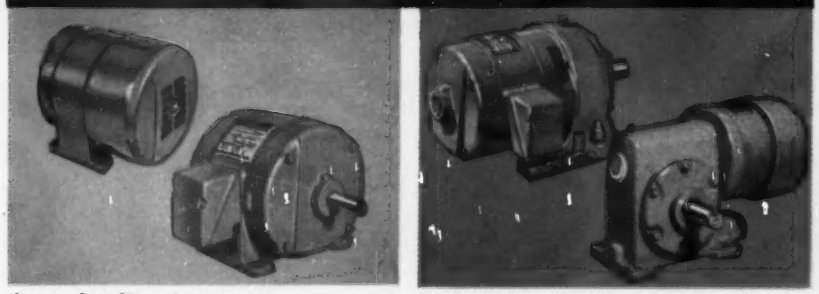
A silicone Dri-film* coating makes insulation shed water—lengthens motor life. Polyester-film insulation is 8 times stronger.

EASIER INSTALLATION



Perma-numbered leads are always instantly read even when wires are taped or clipped. Conduit box has plenty of knuckle room.

COMPLETE LINE OF NEW MOTORS



A complete line of new motors assures the right electrical drive for your machine. Write for Bulletin GEA-6013 on dripproof motors, GEA-6012, on enclosed motors. For low speed jobs, G.E. offers a complete line of gear-motors. Write for Bulletin GEA-6027.

NEAR-BY SERVICE

CLASSIFIED
Electric Repair Service
—(Continued)
GENERAL ELECTRIC
SMALL MOTOR SERVICE STATION
Complete facilities for in and out-of-warranty repair or exchange of A-C and D-C motors and generators to 15 HP. Authorized distributor G-E motor renewal parts and G-E single phase motors.
"WHERE TO CALL"
AUTHORIZED G-E MOTOR SERVICE
Street Address.....Phone No.

G-E service is as close as your telephone. Authorized motor service stations provide repair-facilities in all major trading areas.

*Reg. trade-mark of General Electric Co.

Progress is our most important product

GENERAL ELECTRIC

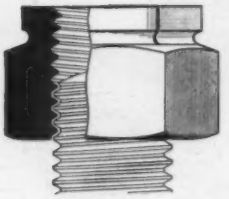
This portable electric hammer is completely self-contained. So are the one-piece, all-metal FLEXLOCs that hold it together, even under the intense impact vibration induced by the rapid hammering action.

FLEXLOCS chosen to withstand vibration of 3000 hammer blows per minute

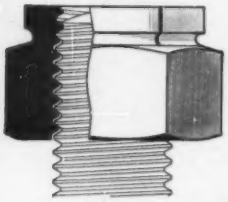
The manufacturer of this portable electric hammer reports, "FLEXLOC Self-Locking Nuts have solved our problem of obtaining a desirable fastener, because they withstand the terrific vibration induced by the impact of 3000 hammer blows per minute without working loose."

This portable electric hammer is subjected to terrific impact-induced vibration. The fasteners that hold it together must take the same beating. The FLEXLOCs were selected only after numerous fastening devices had been tested. Two ¼"-20 nuts hold the fastening bolts securely in position on the forward end of the hammer. One 1"-14 nut prevents loosening of the components at the nose.

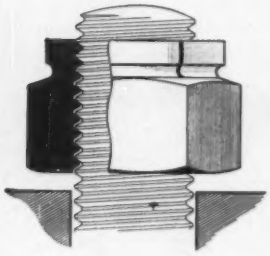
You can get FLEXLOCs of various types and materials in a wide range of sizes and in any quantity. And these one-piece, all-metal locknuts are carried in stock by leading industrial distributors everywhere. See your FLEXLOC distributor or send for literature and samples. STANDARD PRESSED STEEL CO., Jenkintown 1, Penna.



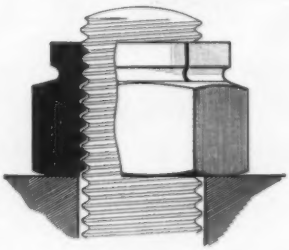
Starting. A FLEXLOC starts like any ordinary nut. Put it on with your fingers. Tighten it with a standard hand or speed wrench.



Beginning to Lock. As the bolt enters the segmented locking section, the section is expanded, and the nut starts to lock.



Fully Locked As a Stop Nut. When 1½ threads of a standard bolt are past the top of the nut, the FLEXLOC is fully locked. A FLEXLOC does not have to seat to lock.



Fully Locked As a Seated Nut. When it is used as a lock or stop nut, the locking threads of the FLEXLOC press inward against the bolt, lifting the nut upward and causing the remaining threads to bear against the lower surface of the bolt threads. Vibration will not loosen a FLEXLOC, yet there is no galling of threads.

FLEXLOC® LOCKNUT DIVISION

SPS JENKINTOWN PENNSYLVANIA

NIAGARA

ANNOUNCES

new all steel BENDING ROLLS

- Produces commercially true cylinders from thinnest sheets to maximum capacity.
- Rolls a multitude of bends in various shapes including oval forms, rectangular pipes, rounded end containers, cones etc.
- Pinch-type construction materially reduces flat spots on leading and trailing edges of work.
- All three rolls power driven permitting smaller diameters and easy operation with light gage sheets.
- Air operated drop end automatically tilts upper roll for easy removal of rolled cylinder.
- Power adjustment for rear roll saves time and effort.
- Roll position indicators allow operator to quickly duplicate roll settings for repeat jobs.
- Rapid reversal and positive jogging of rolls gives operator accurate control at all times.
- Magnetic brake on main motor prevents "drifting" of work, enabling operator to do accurate work without guessing.
- Unbreakable steel construction. ▶ No special foundation required.

6" Roll Series
Capacities 5/16"x 48";
3/16"x 72" and 12 ga x 120"

Write for new Bulletin 88

NIAGARA MACHINE & TOOL WORKS • BUFFALO 11, N. Y.

America's Most Complete Line of Presses, Shears, Machines and Tools for Sheet Metal Work

DISTRICT OFFICES: DETROIT • CLEVELAND • NEW YORK • PHILADELPHIA

Dealers in principal U. S. cities and major foreign countries

Cut Costs and Increase Efficiency with

HELLER MACHINE COMPANY

114 LIBERTY ST.
NEW YORK 6, N. Y.

Importing Heller Machines Since 1926

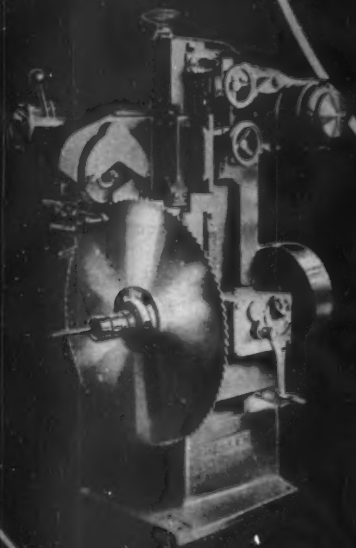
RADIAL DRILLING MACHINES

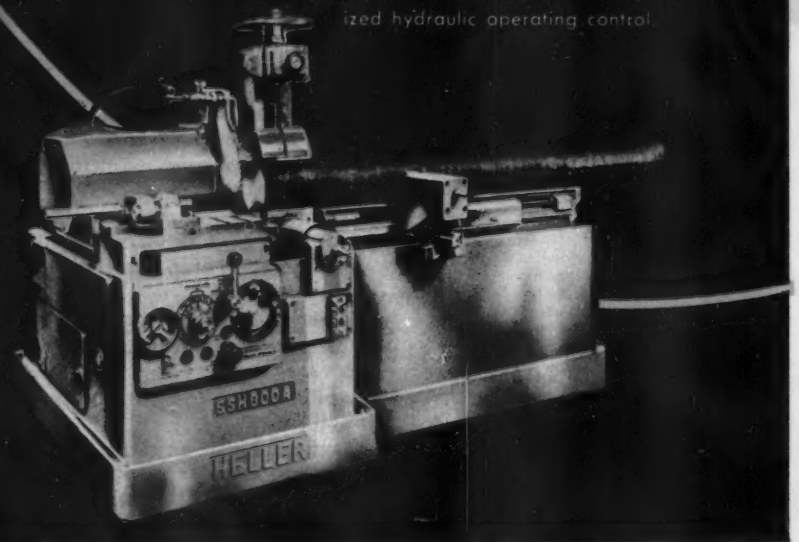
Heller Radial Drills are built in 2½ foot, 4 foot and 5 foot types with 16" diameter column and complete hydro-electric control. We also offer Column Drilling Machines and Gang type drilling machines.

Heller gives you complete service with exactly correct blades.

COLD SAWS

Heller Cold Metal Sawing Machines are built in semi-automatic and full automatic types, ranging from 3" to 48" billet capacity. They have completely centralized hydraulic operating control.





AUTOMATIC SAW SHARPENING MACHINE

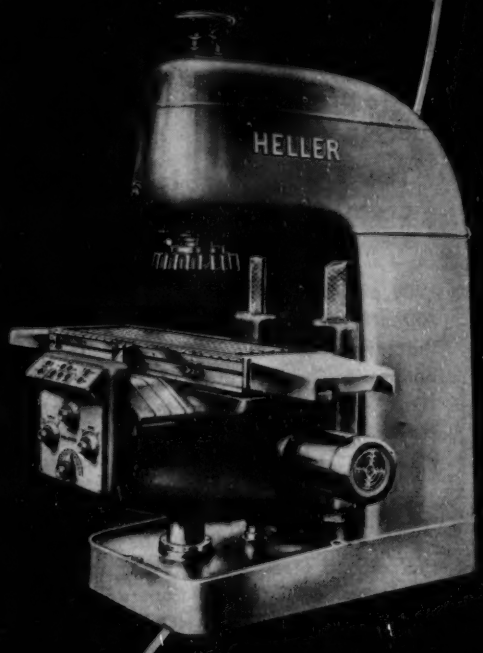
Heller Blade Sharpening Machines are built in five sizes for 2½" to 120" diameter saw blades.

KNEE & PLANER TYPE MILLING MACHINES • COLD SAWING MACHINES • SAW

HELLER
MACHINE TOOLS

LONG BED TYPE MILLING MACHINES

Heller Long Bed Type Milling Machines are offered in medium and heavier types with independent electro-hydraulic carriage control and in milling carriage horsepower ranging from 15 to 400 HP per carriage. Built in all standard types and sizes.



KNEE TYPE MILLS

Heller Knee Type Milling Machines are rigidly built for the heaviest production milling with powerful drive units and 18 speeds to taper roller bearing spindle, with control through push button selection, and can be furnished with full automatic cycling control or copy milling control.

SHARPENING MACHINES • SAW BLADES • TRANSFER MACHINES • SPECIAL MACHINES

ARMSTRONG

ARMSTRONG TOOL HOLDERS

answer both . . .

1. **The problem of lowering costs**
2. **The problem of increasing output**

By providing permanent, multi-purpose, inexpensive ARMSTRONG TOOL HOLDERS that use cutters or bits that are quickly ground from standard high speed Shapes (Saving: All Forging, 70% Grinding and 90% High Speed Steel), the Armstrong System of Tool Holders will reduce your tool cost to an absolute minimum.

By providing stronger, more efficient tools, carefully developed for each operation, as well as ARMSTRONG High Speed Steel, ARMALOY Cast Alloy Cutter Bits or Armide Carbide-Tipped Cutters as required for each job, ARMSTRONG TOOL HOLDERS permit greatly increased speeds and feeds, enable you to increase the hourly output of every lathe, planer, slotter, shaper, turret lathe and screw machine.

There is no surer way to lower costs and increase output, than to use the correct ARMSTRONG TOOL HOLDER for each operation on all machines.

Stocked by Leading Tool Departments

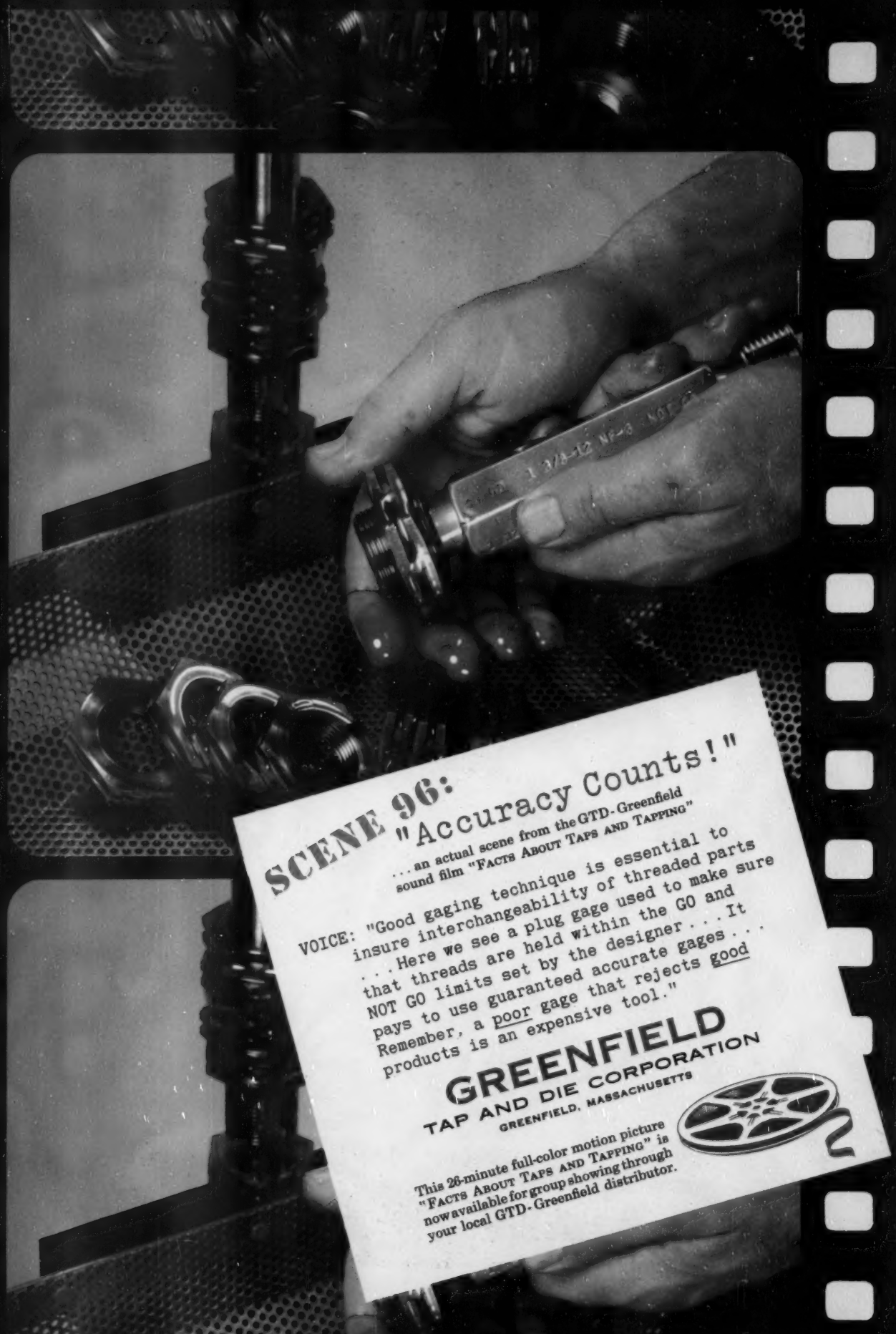
ARMSTRONG BROS. TOOL CO.

"THE TOOL HOLDER PEOPLE"

5215 W. Armstrong Ave. Chicago 30, U. S. A.

New York and San Francisco

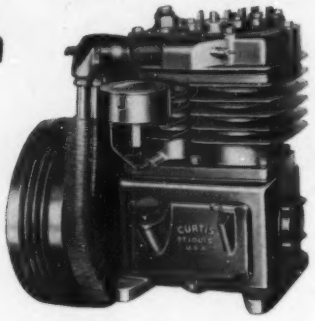
Write for Catalog.


SCENE 96:
"Accuracy Counts!"
...an actual scene from the GTD-Greenfield sound film "FACTS ABOUT TAPS AND TAPPING"
VOICE: "Good gaging technique is essential to insure interchangeability of threaded parts ... Here we see a plug gage used to make sure that threads are held within the GO and NOT GO limits set by the designer ... It pays to use guaranteed accurate gages ... Remember, a poor gage that rejects good products is an expensive tool."
GREENFIELD
TAP AND DIE CORPORATION
GREENFIELD, MASSACHUSETTS
This 26-minute full-color motion picture "FACTS ABOUT TAPS AND TAPPING" is now available for group showing through your local GTD-Greenfield distributor.

Curtis

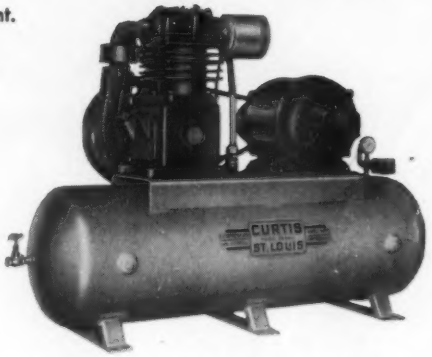
AIR COMPRESSORS, HOISTS and CYLINDERS

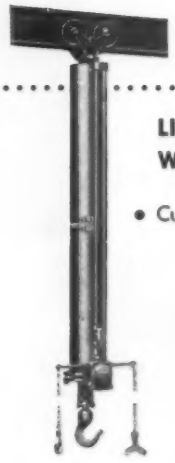
Cut Costs While Speeding Production



AIR TO DO INNUMERABLE JOBS AT LOWER COST WITH A PRECISION-BUILT CURTIS COMPRESSOR

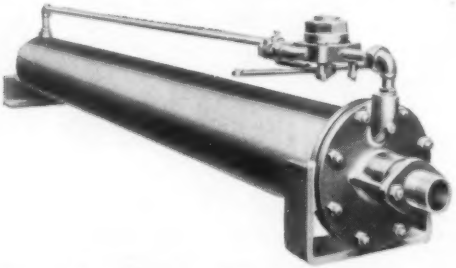
- Timken roller main bearings equipped—easy external adjustment.
- Self-oiling—pressure lubricated rod bearings and piston pins.
- Air-cooled—no danger of freeze-ups.
- Tank Mounted Compressors ¼ H.P. through 15 H.P. (up to 78 cu. ft. displacement per minute)
  Simple Compressors ¼ H.P. through 50 H.P. (up to 300 cu. ft. displacement per minute).





LIFT OR LOWER LOADS QUICKLY WITH A CURTIS "ALL STEEL" AIR HOIST

- Cut costs with these time-saving, work-saving air-powered hoists.



PUSH IT, PULL IT, LIFT IT, LOWER IT WITH A CURTIS "ALL STEEL" AIR CYLINDER

- Curtis Bracketed Air Cylinders can work in any position from horizontal to vertical.
- Delicate control of lifting and lowering speeds.
- Cylinders ground and polished on inside diameter.
- They bring new time-saving ease where lifting, lowering, pulling or pushing is required.
- Valve is disc type. Returns automatically to neutral position when operating chains are released . . . and effectively hold the load.

Get all the facts about cost-cutting Curtis equipment!

1854 **100** *years* 1954

Curtis PNEUMATIC MACHINERY DIVISION
of Curtis Manufacturing Company
1924 Kienlen Avenue • St. Louis 20, Mo.

-806

First name in cutting fluids every season

You'll be reminded of cool fall breezes all year 'round when CIMCOOL° is on your broaching jobs. Because this radically new and different cutting fluid combines friction reduction and cooling capacity in a degree never before attained.

CIMCOOL reduces the distortion of the work piece because this revolutionary cutting fluid cools faster. The broaching tool also stays cool —even to the touch.

CIMCOOL is far superior to old-fashioned petroleum-based cutting fluids because it is a *chemical emulsion*. It replaces all water emulsions and all but a few highly compounded specialty oils.

We'll be pleased to *prove* how CIMCOOL does a better broaching job. For a demonstration, just write us. We'll have one of our Cincinnati Milling-trained machinists call on you—without cost or obligation. Or, if you prefer, write for our free booklet, "Cimcool Defeats Heat." Address Sales Manager, Dept. A-104, Cincinnati Milling Products Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.

°Trade Mark Reg. U.S. Pat. Off.

CIMCOOL

for 85% of all metal cutting jobs

A PRODUCTION-PROVED PRODUCT OF THE CINCINNATI MILLING MACHINE CO.

PAN AMERICAN
Grinds holes plus 0.0003", minus 0.0000" on RIVETT

Magneto Bearing Support. Bearing size is 1.5749" dia. Tolerance is plus 0.0003", minus 0.0000".

Rivett Model 1024 Internal and Universal Grinder. Double-end wheelhead swivels 180° for quick conversion. Holes to 9" dia.; external to 12" dia. Collets mount directly in workhead spindle.

Maintenance contributes to Pan American World Airways System's excellent reputation for safety and dependability.

At the Latin American Division Overhaul Base in Miami, Fla., Pan American has been using a Rivett Model 1024 Internal and Universal Grinder on small hole work for 3½ years.

Pan Am states: *"The Rivett Grinder is in operation during two eight-hour shifts per day, five days per week. The only service has been lubrication and replacement belts. It is considered the most accurate and productive universal grinder in the shop. We have another machine on order."*

This testimony to Rivett accuracy and productivity has company in similar statements by other Rivett users. Write for Bulletin 1024B and get the details of how Rivett can improve your toolroom and small lot grinding.

RIVETT LATHE & GRINDER, INC., BRIGHTON 35, BOSTON, MASS.

Rivett Lathe & Grinder, Inc.
Dept. AMR10 Brighton 35, Boston, Mass.
Send Free 12-page Catalog 1024B.

Name_____

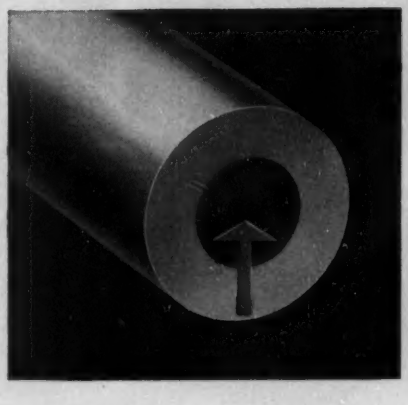
Company_____

City_____ State_____

RIVETT

A Symbol of Accuracy in Machine Tools

a hole here is a nuisance...



a hole here is an advantage

Crucible Hollow Tool Steel Bars are saving time and money for more and more members of the metalworking industry. By using these hollow bars you eliminate drilling and boring operations, increase machine capacity and cut scrap losses.

Now, you can get hollow bars of any of Crucible's famous tool steel grades, in almost any combination of O.D. and I.D. sizes. And you can get *immediate* delivery of five popular grades from your local Crucible warehouse—KETOS® oil-hardening, SANDERSON® water-hardening, AIRDI 150® high carbon—high chromium, AIRKOOL® air-hardening, and NU DIE V® hot-work tool steels.

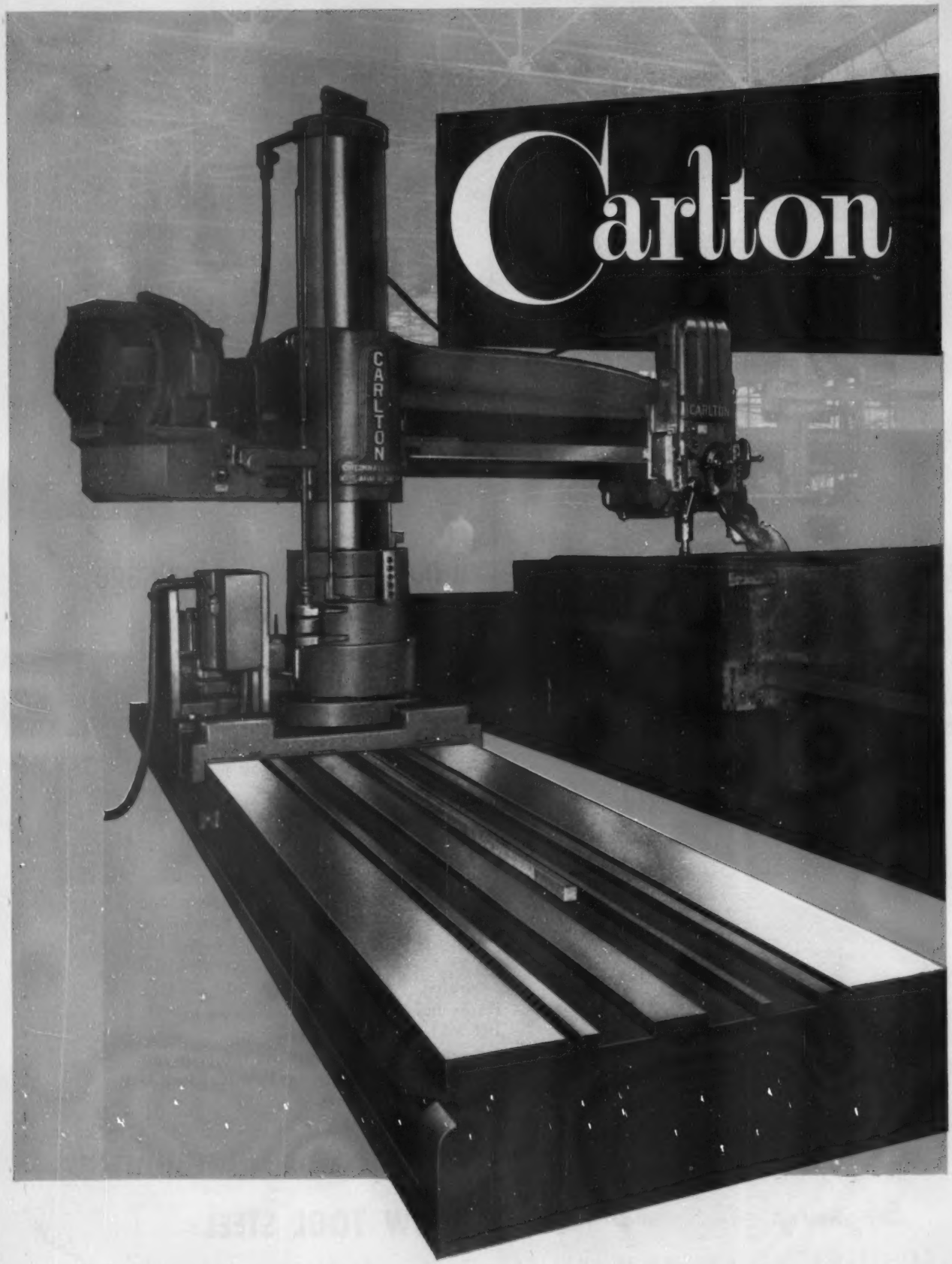
Your Crucible representative can point out ways to save time and money by using Crucible Hollow Tool Steel Bars.

CRUCIBLE first name in special purpose steels

54 years of Fine steelmaking

HOLLOW TOOL STEEL

CRUCIBLE STEEL COMPANY OF AMERICA • TOOL STEEL SALES • SYRACUSE, N. Y.


Carlton
CARLTON
CARLTON

puts you on the track to real hole drilling efficiency!

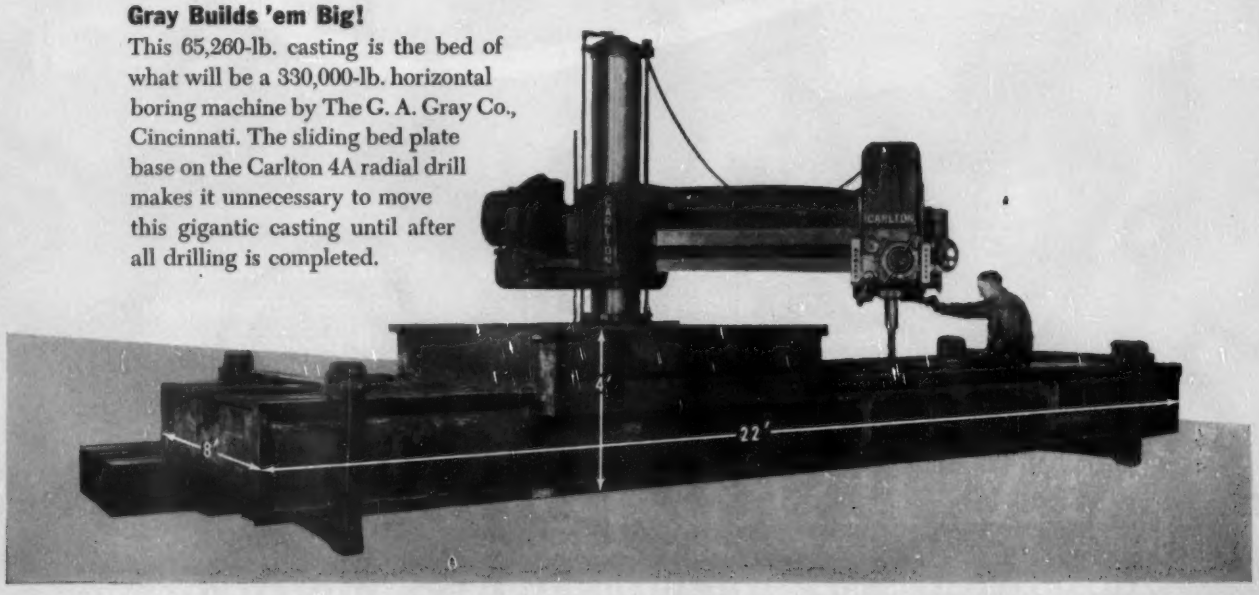
Carlton "gets around." Yes, thanks to its special sliding bed plate base, this Carlton 4A radial drill moves the entire length of this 22-ft long G. A. Gray Co. casting. At one setting it drills the required 75 levelling screw holes without the necessity of lifting so much as an ounce of its 33 tons.

Think what this special Carlton mounting saves in terms of time, energy and expense in drilling this one casting alone! And yet this is but one of many Carlton engineering achievements planned for you . . . to bring you maximum hole drilling efficiency.

Carlton offers seven other types of mountings, plus a variety of plain or uni-tile tables and revolving jigs. And there's an equally wide choice in the Carlton radial drills themselves, too: many different models with arm lengths from 3-ft to 12-ft, column diameters from 9" to 26".

Carlton engineers will be glad to work with your engineers in laying out the most efficient radial drill set-up for your requirements. For maximum hole drilling precision and production today and tomorrow, check Carlton now. The Carlton Machine Tool Co., Cincinnati 25, Ohio.

Gray Builds 'em Big!
This 65,260-lb. casting is the bed of what will be a 330,000-lb. horizontal boring machine by The G. A. Gray Co., Cincinnati. The sliding bed plate base on the Carlton 4A radial drill makes it unnecessary to move this gigantic casting until after all drilling is completed.



"STANDARD for cutting metal and costs since 1881"

Red Shield says:

Cut machining costs . . . standardize with Standard. Complete line . . . top quality tools. Backed by factory application specialists coast to coast. Distributors in all principal cities.

STANDARD TOOL CO.

3950 CHESTER AVENUE — CLEVELAND 14, OHIO

FACTORY BRANCHES IN: NEW YORK • DETROIT • CHICAGO • DALLAS • SAN FRANCISCO

THE STANDARD LINE: *Twist Drills · Reamers · Taps · Dies · Milling Cutters · End Mills · Hobs · Counterbores · Special Tools*

Do your machines have a built-in FUTURE?

LEES-BRADNER Model 7-HD
HEVI-DUTY HOBBING MACHINE
Rated capacity in steel . . . . . 4 D. P.
Capacity between centers . . . . . 25"
Maximum Hob Size . . . . . 4"x4"
Max. dia. capacity with 4" hob . 7"
Max. dia. capacity with 3" hob . 8"
Axial shift of hob . . . . . 3"
Weight . . . . . 9,300 lbs

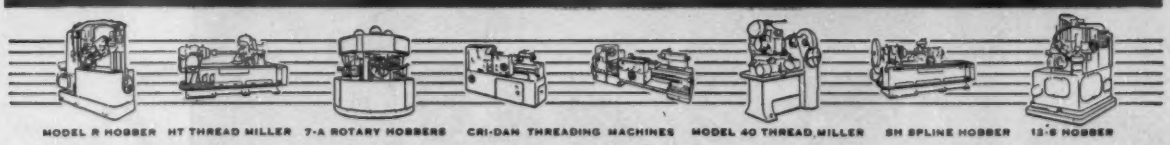
Yesterday's machines were engineered for yesterday's requirements. But the pace of modern industry has changed. The machines you bought yesterday are hard-put to meet today's production demands. They may need replacement.

When you buy your new machine, gear your thinking to the future. Meeting today's production needs is not enough—your machine *must* have a built-in future. It must be engineered to fit tomorrow's production picture, TODAY!

The Lees-Bradner Company manufactures a complete line of hobbing machines that are designed to meet varied requirements. For example, the new 7-HD, Hevi-Duty Vertical Production Hobbing Machine is built to hob *today* at tomorrow's higher feeds and speeds. It's a heavier, more powerful machine equipped to meet industry's demands for savings in time and labor. It has a built-in future, a reserve capacity to produce for today's industry *and* tomorrow's, as well. Your Lees-Bradner representative will be glad to give you the facts. Or, write us direct.

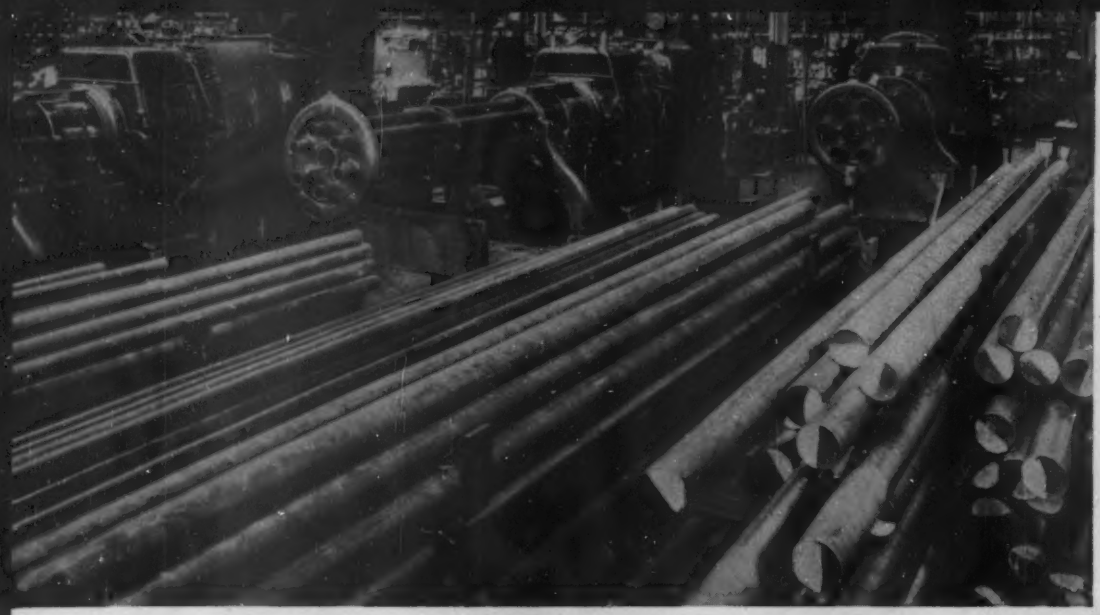
the LEES-BRADNER *Company*

CLEVELAND 11, OHIO, U.S.A.

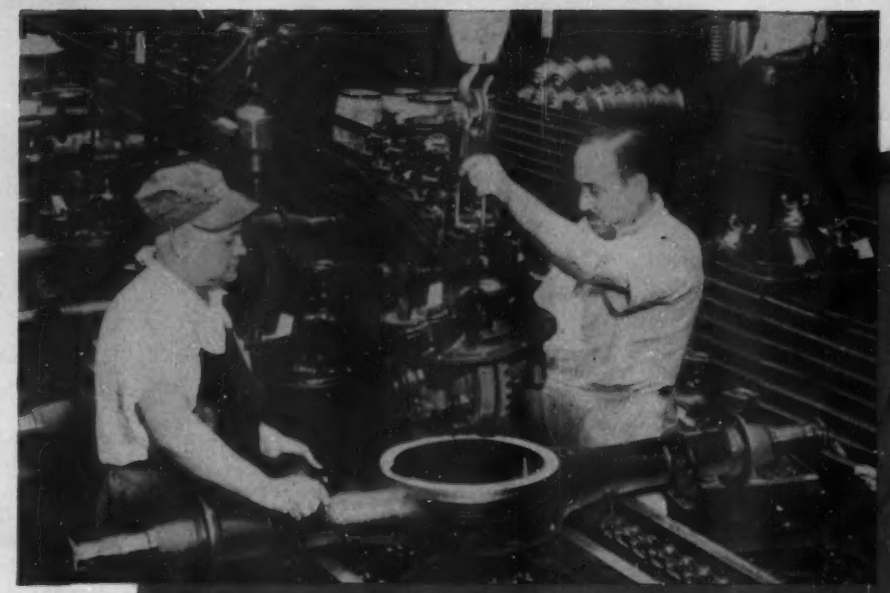


MODEL R HOBBER · HT THREAD MILLER · 7-A ROTARY HOBBERS · CRI-DAN THREADING MACHINES · MODEL 40 THREAD MILLER · 8H SPLINE HOBBER · 12-S HOBBER

IF YOU THREAD OR HOB . . . GET A BETTER JOB WITH A LEES-BRADNER

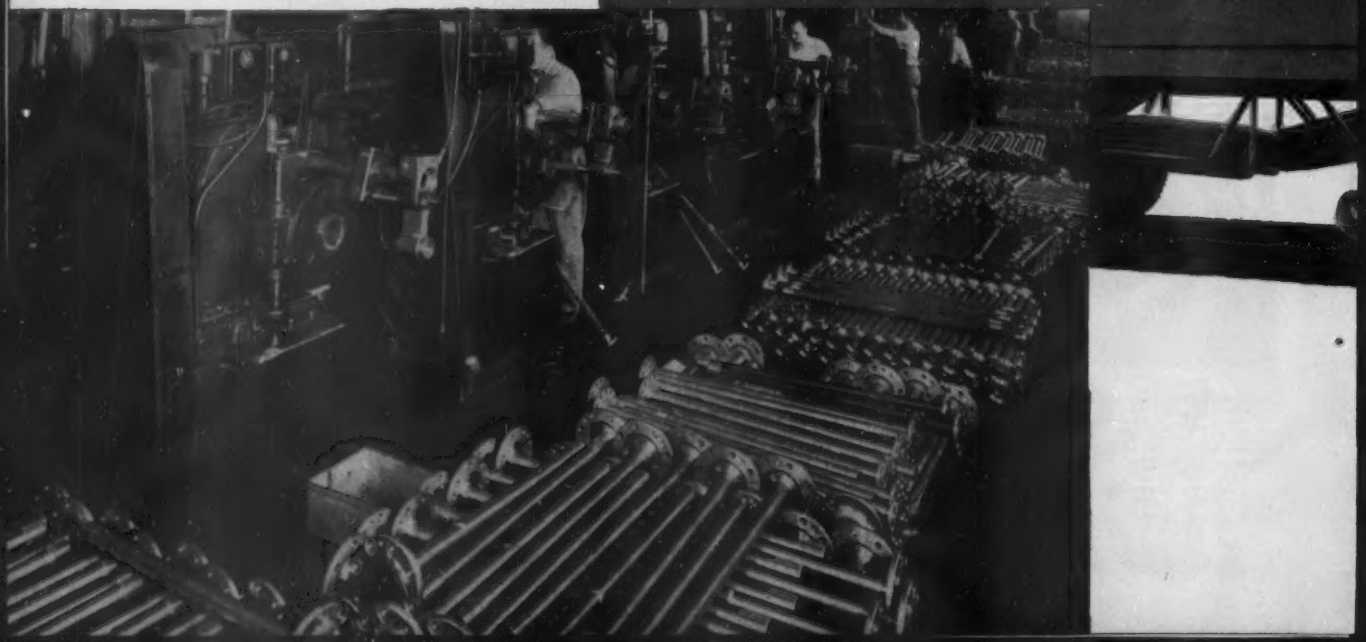


ABOVE
Idler and side pinion blanks are cut from alloy steel rounds in automatic bar machines. Teeth are then machined in the blanks, and the pieces are carburized, hardened, and finish ground.



RIGHT
Final assembly of a completed axle unit.

BELOW
After heat treatment, hardening, straightening, and grinding, axle shafts come to this machining line to be turned, spot faced and hobbed. These axles must withstand hard service in tractor-trailers, farm trucks, and dump trucks.

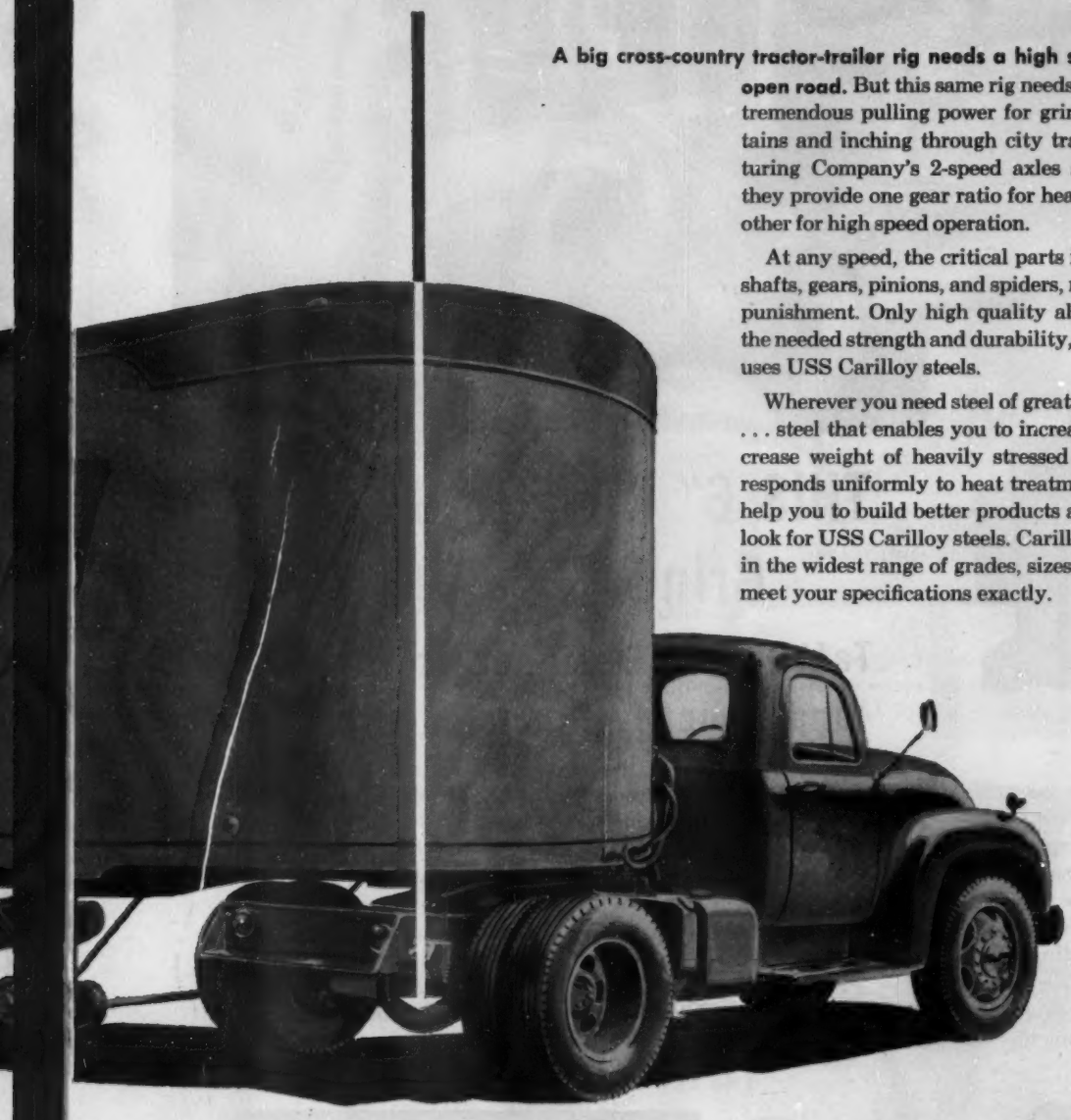


USS Carilloy steel
used in axles of heavy-duty trucks

A big cross-country tractor-trailer rig needs a high speed axle on the open road. But this same rig needs a *low* speed axle with tremendous pulling power for grinding up steep mountains and inching through city traffic. Eaton Manufacturing Company's 2-speed axles solve both problems: they provide one gear ratio for heavy pulling power, another for high speed operation.

At any speed, the critical parts in these axles, such as shafts, gears, pinions, and spiders, must withstand severe punishment. Only high quality alloy steels can supply the needed strength and durability, and that's why Eaton uses USS Carilloy steels.

Wherever you need steel of great strength or toughness . . . steel that enables you to increase durability and decrease weight of heavily stressed parts . . . steel that responds uniformly to heat treatment . . . steel that can help you to build better products at equal or lower cost, look for USS Carilloy steels. Carilloy steels are available in the widest range of grades, sizes, and forms—they can meet your specifications exactly.



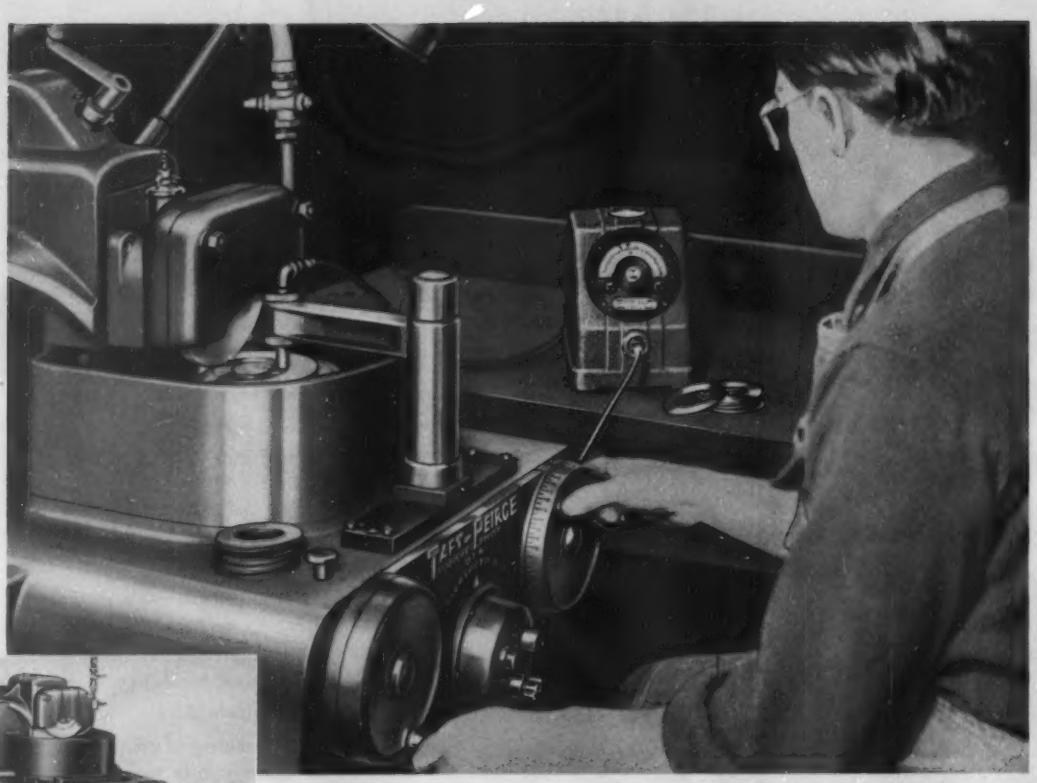
UNITED STATES STEEL CORPORATION, PITTSBURGH • COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA. • UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

Carilloy USS Steels

ELECTRIC FURNACE OR OPEN HEARTH — COMPLETE PRODUCTION FACILITIES IN CHICAGO OR PITTSBURGH

4-2002

UNITED STATES STEEL



Grinding slitting knives to within .0001". Air gage permits on-the-job size control.

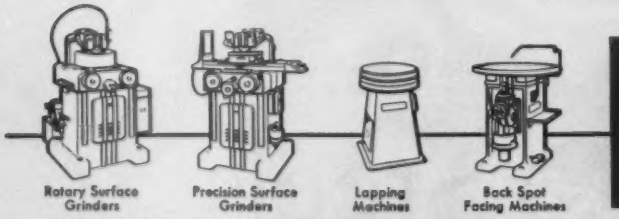
THIS 6" ROTARY GRINDER Grinds To .0001"

Taft-Peirce Designed It To Speed and Simplify Precision Grinding

Hard to believe but true — this Taft-Peirce 6" Rotary Surface Grinder makes grinding to .0001" an amazingly simple job. Exceptionally accurate, sturdy, vibrationless. An exclusive vernier feed permits precise vertical settings of .0001" instantly . . . exactly. Takes the guesswork out of finish grinding. Gives you flatter, finer surfaces.

And here are two more important features. A simple adjustment tilts the wheelhead up to 30 degrees in the vertical plane. The work spindle and superpower magnetic chuck tilt 7½ degrees forward or backward. This chuck holds even very small workpieces firmly and dependably in the center of the faceplate.

Operators report undiminished accuracy over unusually long periods, sharply reduced wheel-wear, and negligible maintenance. Ask for the Taft-Peirce 6" Rotary Grinder Bulletin for more information.



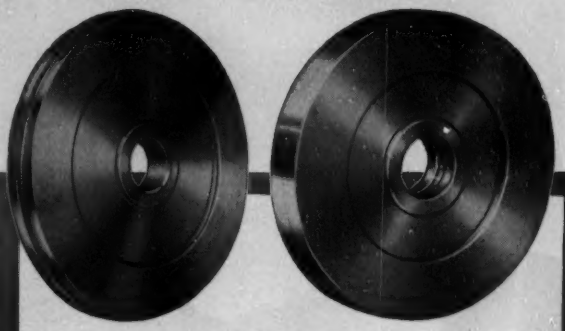
Rotary Surface Grinders | Precision Surface Grinders | Lapping Machines | Back Spot Facing Machines

T-P means Top Precision

THE TAFT-PEIRCE MANUFACTURING COMPANY, WOONSOCKET, RHODE ISLAND

MACHINE HIGH SPEED STEEL FORGINGS

Profitably... Automatically



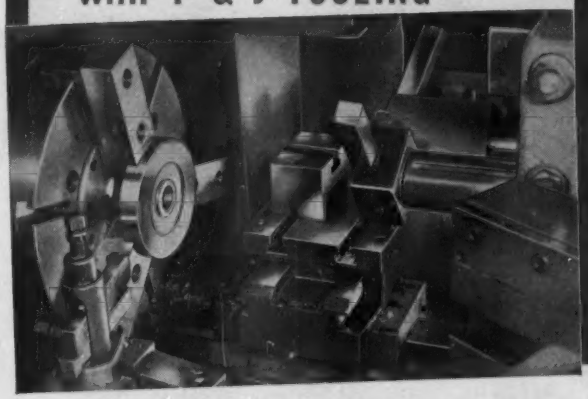
AN ACTUAL CASE HISTORY
involving:

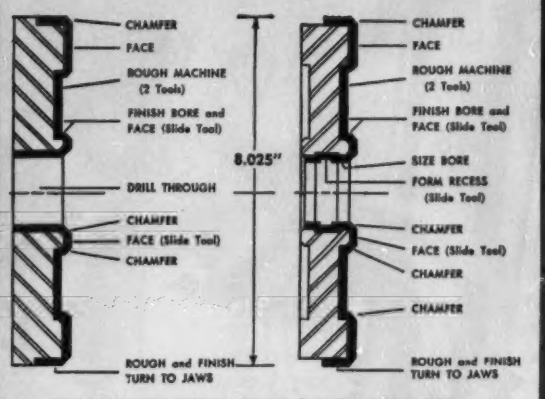
PART: 8" cutter blank, HSS forging

TIME: 9.69 minutes (floor-to-floor) for both operations

MACHINING: 24 separate rough and finish cuts, 11 in first operation, 13 in second operation

DONE ON A:
POTTER & JOHNSTON 4-U
WITH P & J TOOLING





The Potter & Johnston 4-U Automatic Turret Lathe is specifically designed and manufactured to give you the extra speed, power and rigidity needed to machine today's tough alloys faster, more economically. In addition, the 4-U is unusually versatile . . . combined with expert P&J Tooling, it offers new opportunities for increased profits on a wide variety of work types and sizes.

If your present equipment can't deliver performance like the job shown here, you owe it to yourself to learn more about the new 4-U Automatic.

SEND NOW FOR COMPLETE INFORMATION. Write direct or contact your nearest Pratt & Whitney Branch Office; ask for your copy of the 4-U Circular and the "34 Practical Production Ideas" Booklet — to help you increase output and reduce costs.

MODERNIZE with POTTER & JOHNSTON REPLACE FOR PROFIT

POTTER & JOHNSTON CO.
PAWTUCKET, RHODE ISLAND
SUBSIDIARY OF
PRATT & WHITNEY
DIVISION NILES – BEMENT – POND COMPANY

P&J

BIRMINGHAM • BOSTON • CHICAGO
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LOS ANGELES • NEW YORK • PHILADELPHIA
PITTSBURGH • ROCHESTER • SAN FRANCISCO • ST. LOUIS

EXPORT DEPT., PAWTUCKET, R. I.

AGENTS: DALLAS, THE STANCO CO.
HOUSTON, WESSENDORFF, NELMS & CO.

PRECISION PRODUCTION TOOLING FOR MORE THAN FIFTY YEARS

TEAMWORK

In the 1860's, a hundred courageous riders and over 400 mounts, kept the Pony Express open from St. Louis to San Francisco, through sheer unity of purpose.

The understanding between the rider and his mount exhibited the kind of teamwork that kept this chain unbroken — from one relay station to another — until the challenge had been met . . . the final goal accomplished.

Bath sales representatives are an important link in the chain between the customer and the Bath plant. Trained to interpret tap problems, they quickly pass on the necessary details to Bath engineers — another link in this important chain.

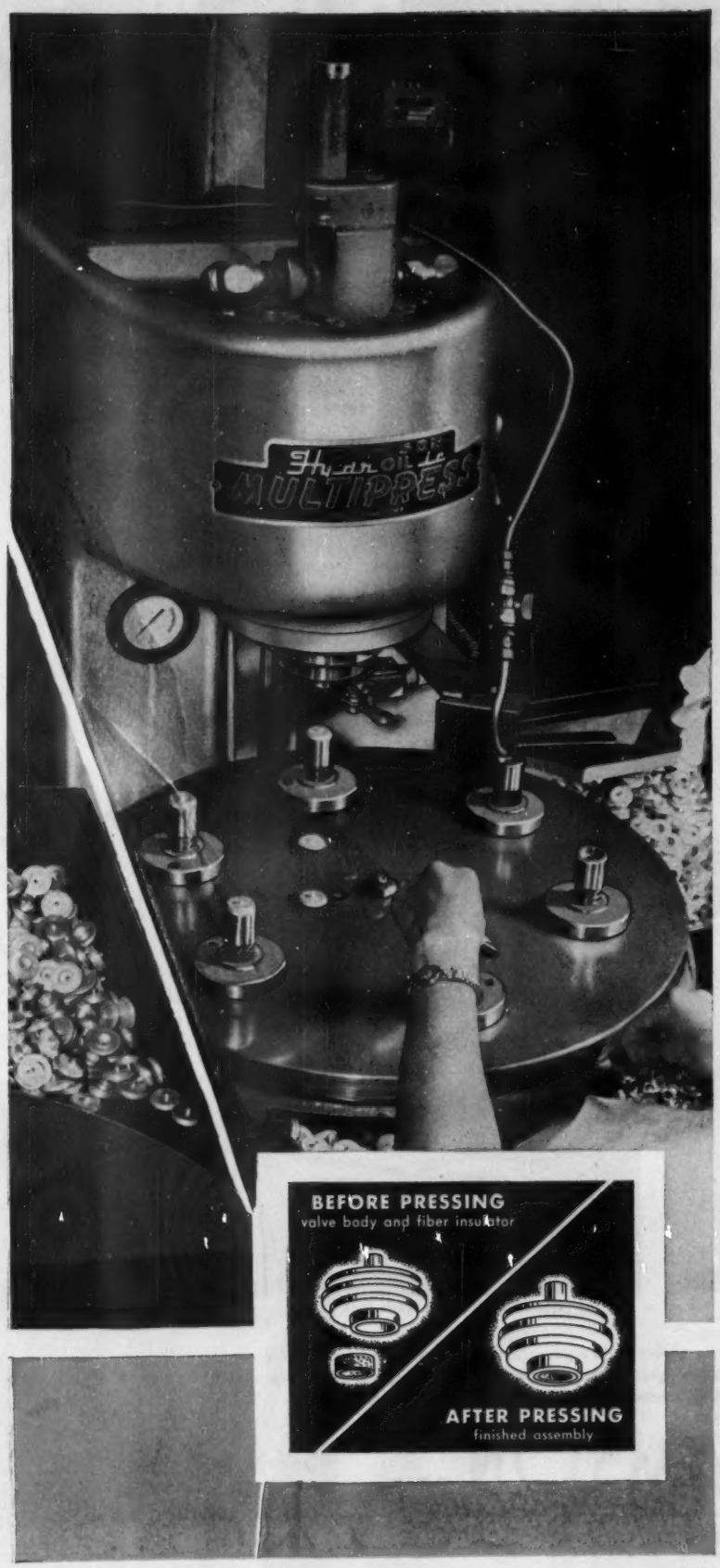
Bath ground thread taps — regular and custom built — are made with but one purpose in mind . . . to do the best threading job for your requirements. Let the Bath representative tell you how Bath teamwork spells *tap economy* for you!

Bath engineers check every detail, to see that all Bath Taps are conditioned to do the best threading job for your requirements.

Insist on BATH TAPS for BETTER THREADS

JOHN BATH & CO., Inc.
22 Grafton St., Worcester, Mass.

PLUG CYLINDRICAL AND THREAD GAGES • RING THREAD GAGES • GROUND THREAD TAPS • INTERNAL MICROMETERS



4 times faster with DENISON MULTIPRESS®

FROM 7 a minute to 30 a minute—by switching to Denison hydraulic Multipress.

Pressing fiber insulators into gas control-valve bodies was a slow process using an air cylinder method. Now, a 4-ton Multipress does it 300% faster. The reasons: Faster loading of parts, continuous operation on preset time cycles, automatic ejection of finished parts.

With Denison hydraulic Multipress, the operator simply loads insulators on a rotary Index Table. The Index Table carries the parts under the hydraulic ram. One smooth hydraulic stroke presses the insulator into the gas control-valve body.

Denison Multipress increases production on many types of jobs in the 1-to-75-ton pressure range. Ask for cost-cutting ideas and technical bulletins.

THE
DENISON ENGINEERING COMPANY
1164 Dublin Road • Columbus 16, Ohio

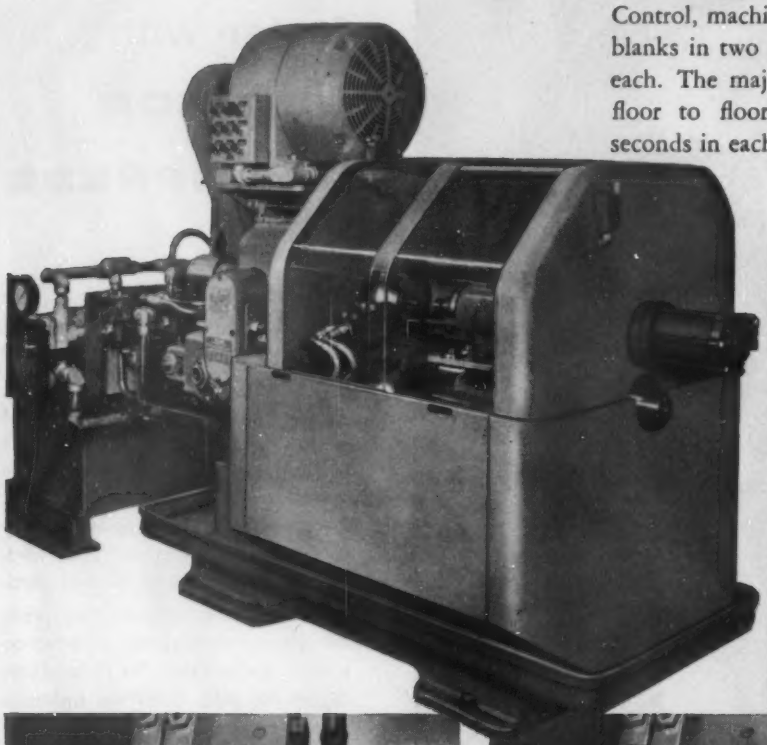
DENISON
Hydroil ics

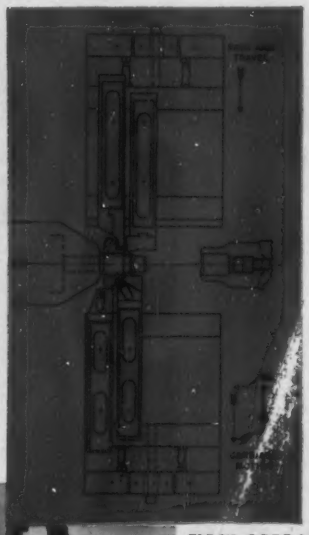
Fay Automatics combine **AUTOMATICITY** and **HIGH VELOCITY TURNING**

with results like this —

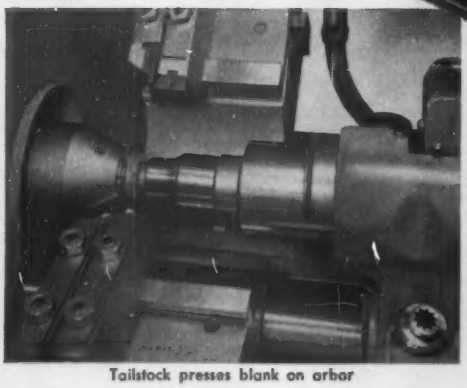
SIDE GEARS
18 Seconds Floor to Floor—635 SFM

Two 8" Fays, with Automatic Sequential Control, machine all exterior surfaces of the blanks in two operations; one machine for each. The major diameter is 2-15/16" and floor to floor time is approximately 18 seconds in each operation.

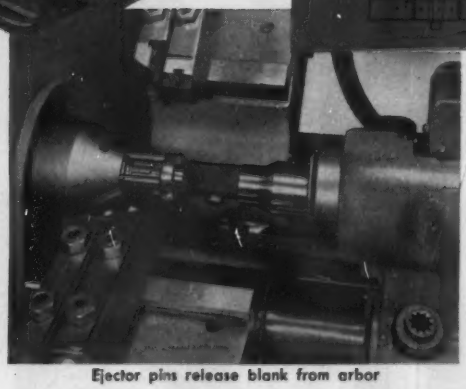




FIRST OPERATION: Note intricate movements of the carriage, which turns the hub, back angle and major diameter. The back arm faces and forms.



Tailstock presses blank on arbor



Ejector pins release blank from arbor

Production management regularly relies upon the engineering services of Jones & Lamson for the latest information on methods, costs, tooling and performance. Why not consult us about YOUR *turning, threading and inspection problems?*

JONES & LAMSON

Machine Tool Craftsmen Since 1835

JONES & LAMSON MACHINE CO., 502 Clinton St., Dept. 710, Springfield, Vt., U.S.A.

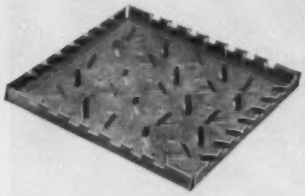
J&L MACHINE TOOL DIV.

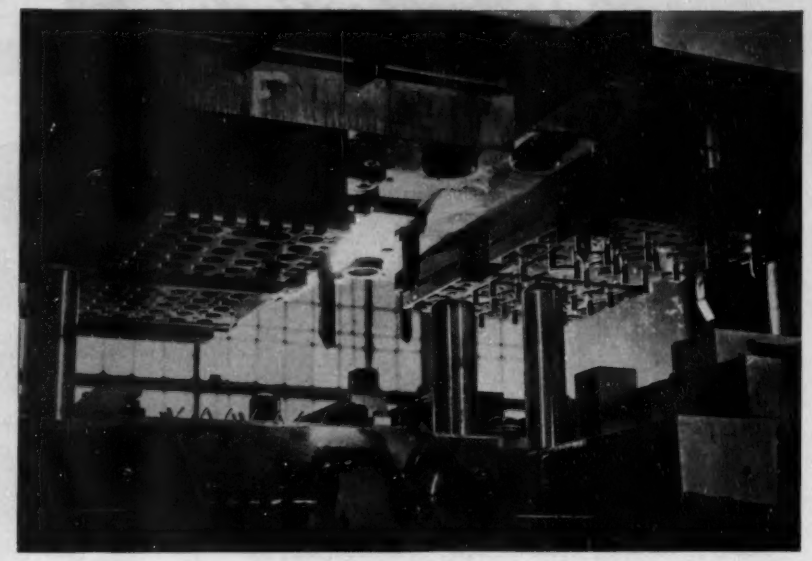
Tool Steel Topics

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributors: Bethlehem Steel Export Corporation

LEHIGH H DIE PRODUCES INTRICATE FLOOR-PLATE SECTION





The picture at the upper right shows the business end of a large blanking-and-forming die, used in making floor-plate sections for Flash-Stone Company, Inc., Philadelphia. The photograph below shows 11-gage sheet steel being fed into an 850-ton press, beyond operator, where it undergoes initial blanking and forming. Additional forming, plus trimming, are done in a return pass, at operator's left. Above appears the finished product, an 11¾-in. square, with numerous lugs on the top and sides for gripping the concrete.

The die, made of Lehigh H tool steel, is providing long production runs because of its good resistance to wear and shock. Redressing is seldom required.

Lehigh H is a high-carbon, high-chromium, air-hardening tool steel, well known for its easy machinability and easy heat-treatment. It's a deep-hardening steel, too, with high compressive strength.

TYPICAL ANALYSIS

Carbon	1.55	Molybdenum	0.80
Chromium	11.50	Vanadium	0.40

Like to prove to yourself how Lehigh H Tool Steel wears . . . and wears . . . and wears? Call your tool steel distributor, or write a line direct to us at Bethlehem, Pa.

Sheet steel, being fed into press for initial blanking and forming, is further formed and trimmed on the return pass into the finished floor plate, which is shown on the slide near foot of picture.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

Use Distortion Tests With Care

Distortion of tool steel in heat-treatment is a phase of toolmaking which is often misunderstood. And some of the available distortion-test data adds to the confusion.

Typical of the misleading distortion tests are those on bar stock, about ¾ in. round and 1 in. long. The results are reported as the change in length occurring in the hardening heat-treatment, and certainly do tell what happens when steel of that size is hardened. But how to use this data to predict size changes of tools of other sizes? There's the rub!

The test described implies that the distortion figure for the 1-in. piece can be applied elsewhere—for example, that a 5-in. piece changes 5 times as much, and a 10-in. piece 10 times as much. Not so! Depending on the size and shape of the pieces being hardened, expansion or contraction may occur, but the factor cannot be used to predict which. Therefore the data obtained on the test piece is of limited value, as it applies only to the hardening of tools of the size and shape of the test piece itself. There is no such thing as a single test specimen which predicts size changes in tools of various sizes and shapes.

If you would like additional information on distortion, write for a copy of our article, "Distortion of Tool Steels in Heat-Treatment."

How else could this job be done

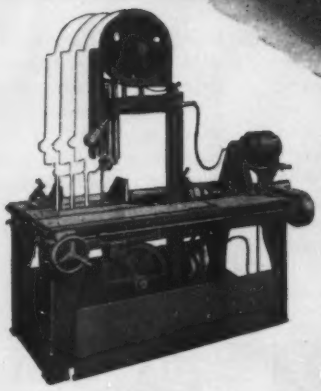
so easily, so accurately and so inexpensively?

Segmentation of 42" Steel Casting

Every tool room, machine shop, die shop and maintenance department needs at least one No. 8 MARVEL Metal-cutting Band Saw for cutting off anything from ⅛" drill rod to bars or billets of 18" x 18" cross-section . . . for roughing large work to size and shape, thereby saving hours of machining . . . for those occasional "trick" jobs, impossible on any other saw, that bob up in every plant.

Odd shapes that can't be held in the removable, quick-action vise, are easily set-up on the No. 8's large, T-slotted work table. MARVEL Overload-Relief Power Feed insures accurate cuts under the most adverse conditions because blade pressures are automatically held within limits which are pre-set instantly for each job. The blade is never forced beyond its capacity to efficiently and accurately remove metal . . .

Close limits are further assured through the work being clamped rigidly to the bed of the saw and the blade power-fed through it instead of pushing the work through the blade. This is also true in miter cutting, as the blade column—*not the work*—is swung to the required angle. The handiest, most versatile machine tool, it is also the busiest in most shops.



This double exposure illustrates how the blade maintains its vertical position while moving into and through the work, impelled by the automatic MARVEL Overload-Relief Power Feed.

Column set at angle to cut 45° miter on 18" beam. Entire saw column can be swung to cut at any angle from vertical to 45° right or 45° left.

MARVEL *Metal Cutting* **SAWS**

Better Machines-Better Blades

Write for Catalog

ARMSTRONG-BLUM MANUFACTURING CO.

5700 Bloomingdale Avenue — *"The Hack Saw People"* — Chicago 39, U. S. A.

No. 4 in a Series

What's in it for you

Before you buy your next multiple spindle automatic bar machine it will pay to ask your Cone Representative about the Conomatic Carbide Development program. He will be glad to tell you what's in it for you.

Among the things that your Representative can tell you is how you can be sure that any brand of "automatic", that you may have under consideration, will be equipped to get the most from any modern tool material, including 100% carbide tipped tool applications.

The part illustrated is from regular production runs with HSS and 100% carbide tipped tools. Full particulars are available.

MATERIAL—COPPER: Hole drilled with ½" dia. drill to 3" depth; taper formed on OD.

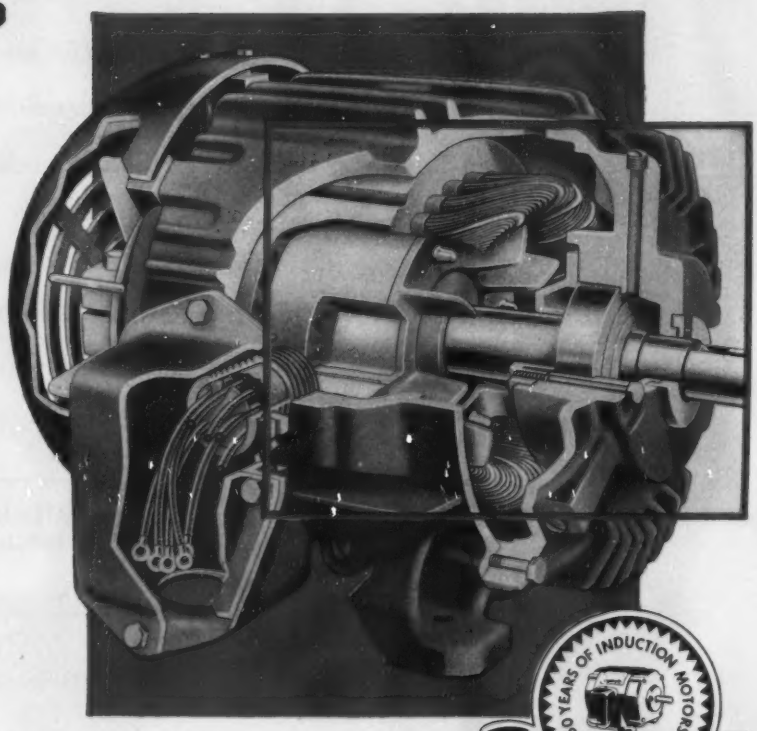
	HSS	CARBIDE
Cycle Time	45 secs.	16 secs.
Work Spindle Speed	670 R.P.M. at 110 S.F.	2026 R.P.M. at 398 S.F.
Tool Wear	150 pcs. per grind	2500 pcs. per grind

Conomatic } CONE AUTOMATIC MACHINE COMPANY, INC. WINDSOR, VT., U.S.A.

It takes Six Bolts—

not just four

to give full bearing protection for greater motor performance



THE TWO EXTRA BOLTS in the end housing of every Allis-Chalmers ball bearing motor are the proof of *extra* protection against bearing failure. These are the bolts that hold the bearing cap tightly in place against the inner face of the bearing enclosure. This cap, with its close running clearances, keeps grease from the interior of the motor . . . retains an ample supply within the bearing enclosure . . . protects the grease and the bearing against contamination from dirt and moisture.

At the outer side of the bearing, double labyrinth seals keep grease in, also keep dirt out. What's more, large grease reservoirs act as additional dirt traps.

Result? Allis-Chalmers motors pay off in longer, trouble-free bearing life, lower motor maintenance.

50 YEARS OF INDUCTION MOTORS
ALLIS-CHALMERS-NORWOOD WKS.

Get all the facts . . . judge for yourself — Compare Allis-Chalmers motors with other motors. Get the six-bolt construction that gives you complete bearing protection. For proof, see your Allis-Chalmers Office or Authorized Distributor, or write — Allis-Chalmers, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

A-C ALLIS CHALMERS

A-4444

The Reader AUDITED PAID CIRCULATION ABC *His Mark*

THE ABC SYMBOL, which appears at the head of this page, is your brand—the reader's brand—on this magazine. It stands for Audit Bureau of Circulations. It means that this magazine will stay in business only so long as it continues to serve its readers to their satisfaction.

That Bureau—known for short as ABC—is a voluntary, nonprofit, cooperative association founded in 1914 by a group of publishers, advertisers and advertising agencies who wanted to establish and maintain higher standards of publishing practices than then prevailed. Its primary and specific purpose was to set up yardsticks to appraise circulation values and to verify the claims of publishers as to their circulations. For the buyer of advertising space this provides an effective means to take some of the guesswork out of buying and to reconcile the conflicting claims of competing publishers. BUSINESS WEEK magazine has aptly described ABC as "the publisher's conscience—and cop."

BUT IN DOING that job, ABC performs another function of high importance to the readers of ABC member publications. It provides a constant pressure on the publishers to keep alive in their staffs a sense of primary responsibility to their readers. That is because the most simple and direct method of making a publication responsible to its readers is to place upon it a purchase price, whether by subscription or newsstand purchase. The right to purchase or to refrain from purchasing a publication gives to the reader and to no one else the power to pass effective judgment on the publisher's success in serving the reading public. Each paid publication will grow or languish, will prosper or fail, in proportion as it wins or loses the following of thousands or millions of readers. The readers, by their patronage, record their judgments as to whether the publisher and his publication are measuring up to their responsibility to them.

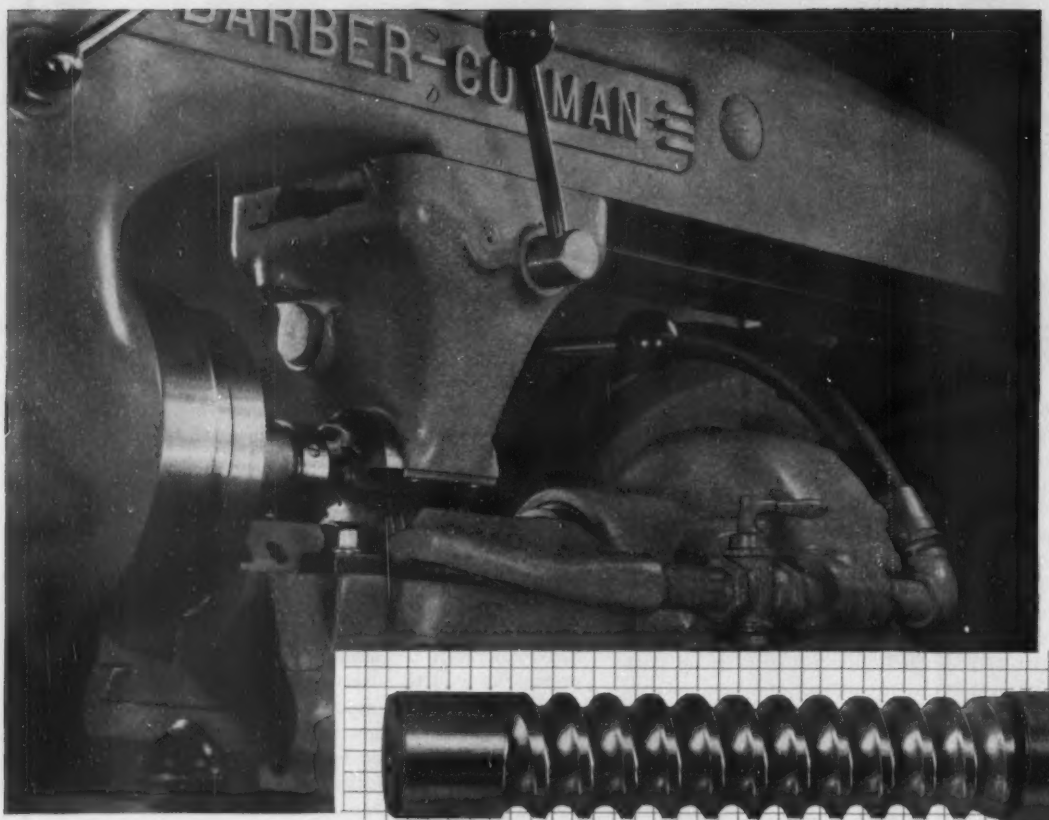
And that is where the ABC comes into the reader's picture. The newspaper or magazine that carries the ABC symbol on its masthead must in the first place be a paid circulation publication. Moreover, it must conform to the high standards set up by the Bureau as to terms of payment and accounting methods. And again it must open all of its books to the auditors of the Bureau on demand.

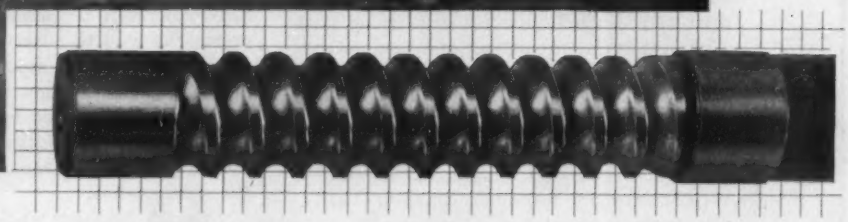
SINCE THE INFORMATION thus determined by thorough and impartial audit is periodically made public through the ABC statements and audit reports, it is constantly available to and universally used by advertisers who are considering the purchase of space in an ABC publication. These reports show the circulation trend, as verified and certified by ABC, and thus put the advertisers in a position to know whether or not the publisher is rendering satisfactory service to his readers.

Thus the publisher who submits his publication to the supervision and discipline of ABC affirms in the strongest possible manner that he recognizes his primary obligation is to his readers and that he owes his standing to a voluntary demand by those readers. It follows that the editors of ABC publications must be exceptionally alert to the desires of their readers and responsive to their needs, since any decline in circulation will soon show up in the ABC statements and audit reports.

THAT IS WHY we describe the ABC symbol as the reader's brand. It shows that a publication must be primarily responsive to him and that he holds in his own hands its success or failure. And that ABC symbol is not only a constant reminder to him of that fact, but also an equally constant reminder to all concerned that the reader's willingness to pay for the ABC publication is the acid test of its value to him and to the advertiser.

McGraw-Hill Publishing Company, Inc.





Standard Hobbing Machines Solve Special Problems

standard barber-colman machines with special tooling cut internal and external threads

The wide range of versatility to be found in the basic design of Barber-Colman Hobbing Machines is illustrated by these internal ball nut and worm shaft threading applications. Standard units and assemblies are used wherever possible for these special applications.

A standard No. 14-15 Hobbing Machine has been equipped with a special hob slide, special work support bracket and modified gear train to thread mill this worm shaft steering part with ease and production economy.

Likewise, a standard No. 16-16 hobbing machine, with special work slide, hydraulic holding equipment, cam vertical feed and special cutter slide replacing the conventional hob slide, is arranged for internal thread milling the ball nut mating part.

These jobs are examples of special applications which can be adapted to standard hobbing machine operation through special tooling and machine arrangements.

thread milling the worm

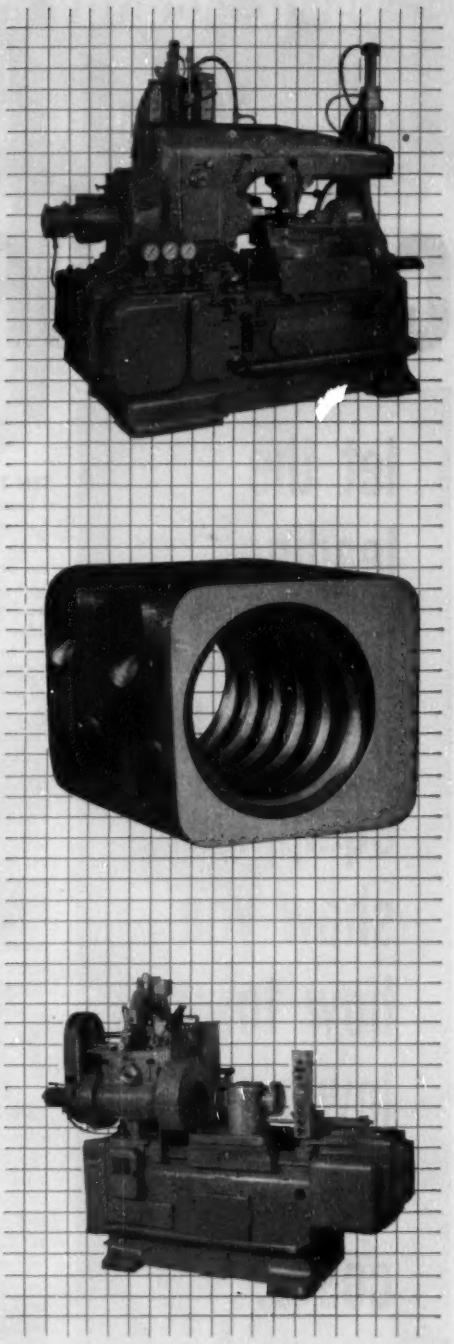
For milling the worm threads, the hob slide is equipped with a thread milling cutter and is positioned 90° from standard, so that the cutter spindle is parallel with the work spindle. The gear train has been modified so that feed and index gears advance the cutter properly to cut the worm threads. The work center bracket support has been designed to provide maximum rigidity of the work piece during the cutting operation. Vertical feed is used to plunge cut to depth, and then the cutter is fed axially to finish the thread.

milling internal threads on the mating part

The machine used to mill the internal threads on the mating part is a special No. 16-16 Hobbing Machine, with special cutter slide positioned permanently so that the cutter spindle is parallel with the work spindle. The gear train has also been modified to advance the cutter in proper relation to the worm threads. Hydraulic holding equipment is employed to clamp the ball nut in position for milling. Clamp and release are operated conveniently by a control valve located on the work slide upright.

Since the No. 16-16 Machine basically does not include vertical feed this arrangement has been added through cam action. A shank-type cutter with special outboard pilot support to steady the cutting action is used, since a small diameter cutter is needed for the internal cut.

When you have problems of producing special forms, equally spaced on a cylindrical base, within the range capacity of standard Barber-Colman hobbing machines, consult our engineers for suggestions on how you may adapt this type of equipment for efficient, economical production. We'll be glad to discuss the adaptation of these machines to meet any of your requirements. Just send us prints or specifications for analysis.



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HOBBING MACHINES
HOB SHARPENING MACHINES

BARBER COLMAN

Barber-Colman Company

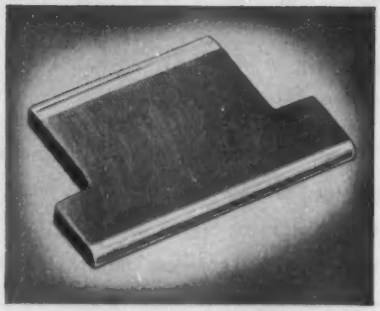
GENERAL OFFICES AND PLANT, 6118 BOOK STREET, ROCKFORD, ILLINOIS

HOBS AND MACHINES SINCE 1911

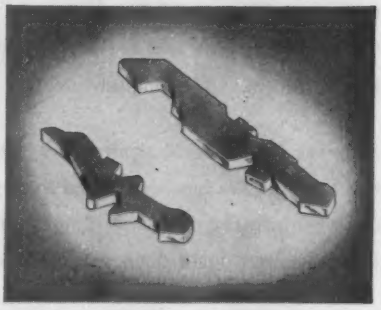
Why wait?
CUT YOUR COSTS NOW!

let the leading manufacturer of broaching equipment show you how to lower your break-even costs.

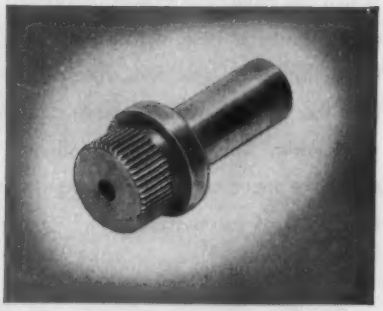
TEN TIMES FASTER than previous methods —broaching top and bottom radii on these automatic transmission reverse band anchors is helping one manufacturer lower the break-even costs. The design called for both edges to be rounded with a taper leading into one of the rounded edges. Besides increasing production by 10 times, the broached surfaces are more accurate, and costs are kept to a minimum. Thousands of these band anchors are being machined between broach sharpenings.



THIRTY TIMES FASTER than milling—broaching lowers costs in the production of the intricate shapes of these copper breaker points. Seven pieces at a time are broached at a rate 30 times faster than by milling. 75,000 pieces are completed before it is necessary to sharpen the broach. 800 to 1000 pieces per hour are broached on one Colonial machine with only two sets of Colonial broaches.

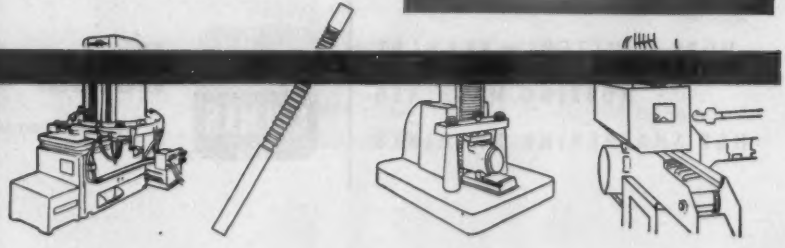


TWENTY TIMES FASTER than other methods —the serrations on the end of this shaft are cut with a button broach in a single pass. Cost per part is reduced substantially because broaching is 20 times faster. This, and hundreds of other applications on file at Colonial, are ample testimony of the tremendous cost-cutting potential that can be yours by utilizing "Unified Broaching" by Colonial. Send us prints of your parts—let us show you how to cut costs over your present machining methods.



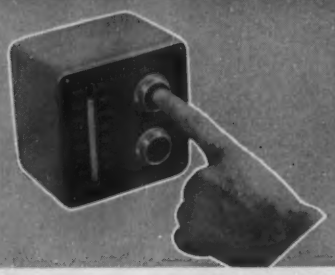
Unified Broaching

COLONIAL



HARDINGE
ELMIRA, N.Y.

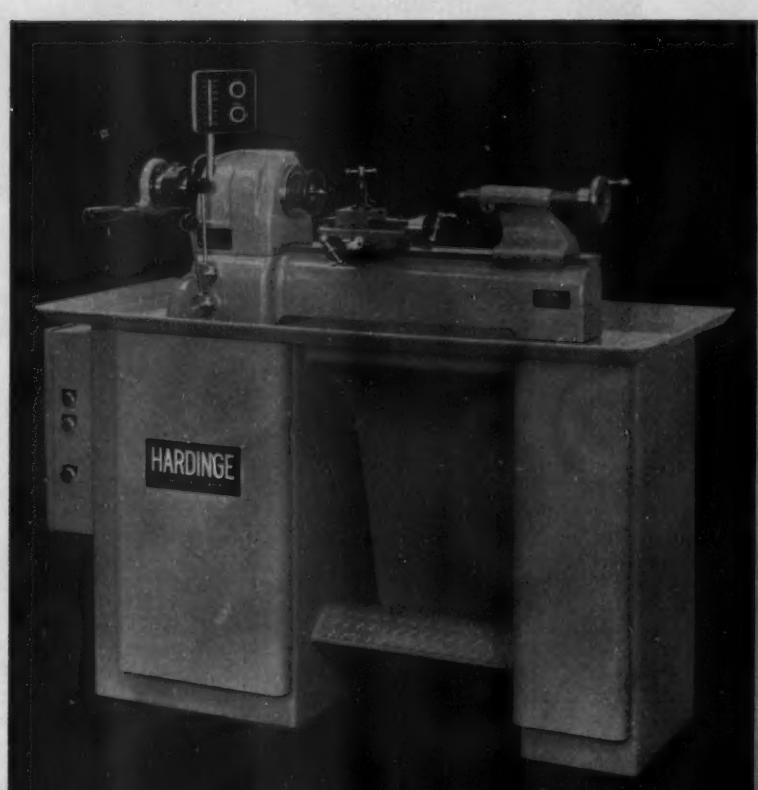
NEW Lathe with Variable Speed for Tool Room—Development—Production Work



Simply Push a Button for Exact Spindle Speeds

It's the NEW Simplified Design

EASY AND CONVENIENT TO OPERATE



FEATURING:

- Infinitely Variable Speeds 230 to 3500 r.p.m.
- Fast Lever Operated Collet with 1⅛" Capacity
- Hardened and Ground Steel Dovetail Bed Ways
- Patented Positive Lock Slide Rest
- Full Bearing Tailstock
- And Other Cost Cutting Features

For Complete Information on this Precision Lathe Write for Bulletin DV59

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

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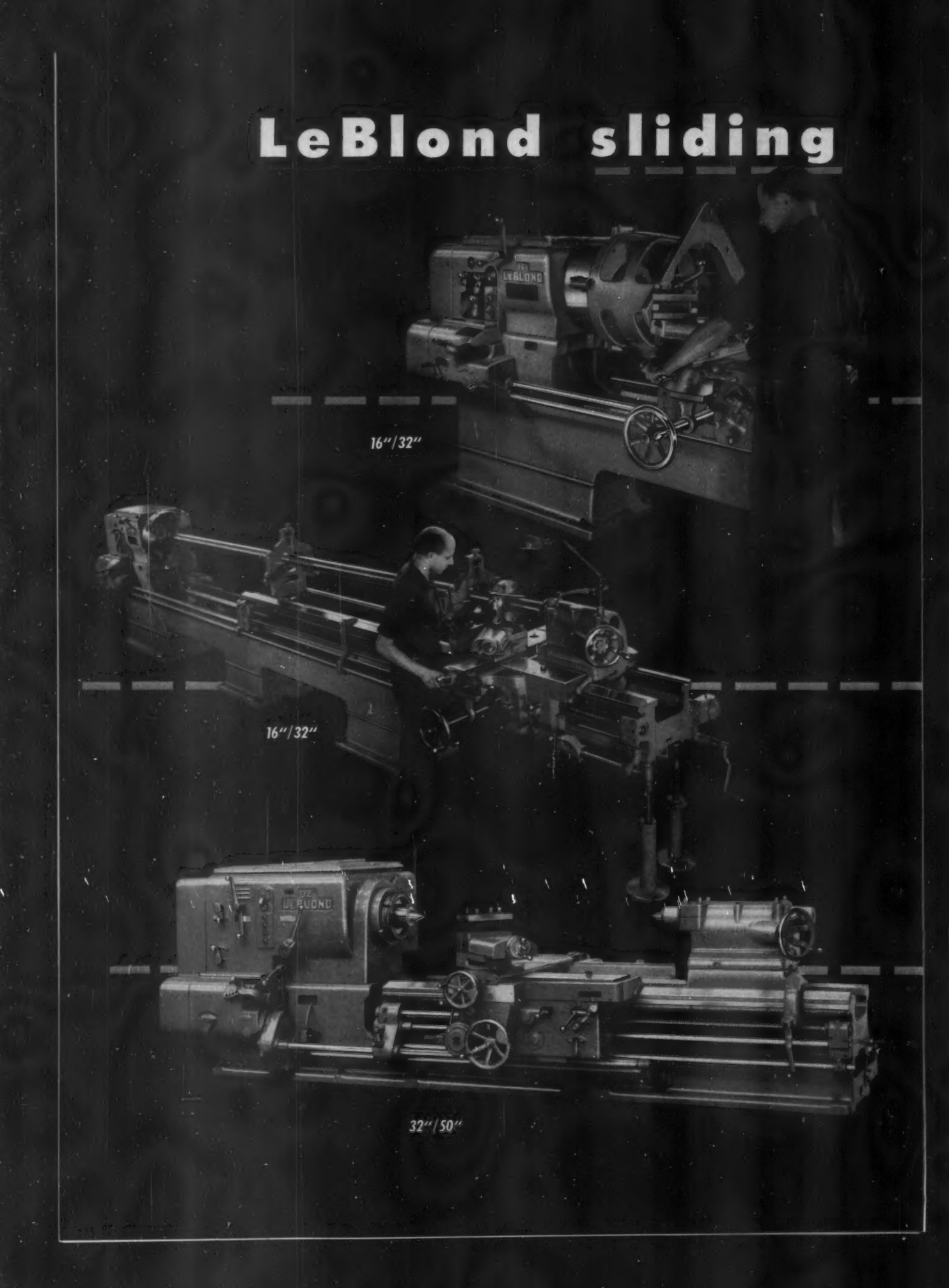
LeBlond sliding



bed gap lathes

4 Sizes, 16"/32", 25"/50", 32"/60" Heavy Duty & 17"/28" Regal

The most versatile lathes in the world give you:

— **Variable gaps for work with large projections**

— **Adjustable center distance for extra-long work**

— **Capacity for all regular engine lathe work**

For complete description and specifications of the 16"/32", 25"/50" and 32"/60" heavy duties ask for Bulletin SBG-103A. 17"/28" Regal, Bulletin RSBG1A

Occasional work with large or irregular projections doesn't warrant buying a large-swing lathe. And extra-long pieces that have to be turned now and then don't justify the cost of a long-bed machine. That's why tool rooms, maintenance departments and contract shops depend on LeBlond Sliding Bed Gap Lathes for *both* out-sized jobs and everyday engine lathe work.

Here's how they work. LeBlond Sliding Bed Gap Lathes are built with two bed sections. The top bed is movable on the lower. With the top bed extended, a wide gap is created providing nearly twice the swing of a conventional engine lathe. Center distance can also be increased greatly allowing long lengths to be turned. With the gap closed this triple-duty lathe does all the work of a heavy-duty engine lathe of comparable size.

LeBlond Sliding Bed Gap Lathes come in four sizes. Three heavy-duties, the 16"/32", 25"/50" and 32"/60"; and a low-cost 17"/28" Regal. These lathes will give you swings up to 61½" and up to 13' distance between centers (base).

And, of course, you get all the well-known LeBlond features. Hardened and ground steel bed ways; low-friction, high-power Spur Gear headstock; totally enclosed quick-change box; automatic lubrication; one-piece apron; thrust-lock tailstock, and many more.

Where utmost versatility is what you need in a lathe, you can't do better than a LeBlond Sliding Bed Gap. Whatever your turning needs may be, one of LeBlond's 76 models is bound to suit. Contact your nearby LeBlond Distributor or write Cincinnati today.

....turned faster by LeBLOND of Cincinnati

THE R. K. LEBLOND MACHINE TOOL COMPANY, CINCINNATI 8, OHIO

WORLD'S LARGEST BUILDER OF A COMPLETE LINE OF LATHES • FOR MORE THAN 67 YEARS.

Keep Your Eye on the OLIVER Line — Cost Cutting Production Boosting MACHINE TOOLS

OLIVER DRILL POINTERS

Properly machine ground drills give better performance. OLIVER Drill Pointers, with each lip doing equal work, give balanced cuts—more accuracy—more perfect holes—more efficiency—longer drill life.

As Illustrated:

No. 21 Oliver Bench Drill Grinder. Hand operated for Drills No. 57 to 1/2".

No. 510 For Drills 1/4 to 3" —2-3-4 flute.

OLIVER DIE MAKING MACHINES

Efficient, speedy and accurate — effecting great savings in time and costs. Skilled labor is not required for sawing, filing and lapping operations.

Available in 5 Models.

Bench Model S-1 (Illustrated) — Single Speed Die Maker for use on Tool Steel up to 1" Thick.

Heavy Duty Model (Illustrated) — 6 speeds, works in metal up to 3" thick, has variable strokes to 5" with hydraulic feed.

OLIVER ACE UNIVERSAL TOOL & CUTTER GRINDERS

Keep your most difficult cutters sharp with Oliver ACES. They excel on high speed and Tungsten-Carbide work. Direct reading for clearances reduces fatigue — eases operators' jobs.

The ACE excels for grinding face mills up to 15" also slab mills • slitting saws • all types cutters and reamers.

2 Models: Heavy Duty (Illustrated) and Standard.

OLIVER 20" TEMPLATE TOOL BIT GRINDER

Efficiently powered by a 3 h.p. motor, this OLIVER Machine grinds on the periphery of a 20" wheel. Capacity: tools up to 1 1/2" wide x 1 3/4" high from 0 to 20° clearance. The OLIVER is developed for production sharpening of single point Tungsten-Carbide and high speed tools—offers increased production, lower tool costs and savings in man-hours. Extremely fine finish assured.

Write Today For Complete Information

OLIVER INSTRUMENT CO.

1913 E. MAUMEE • ADRIAN, MICHIGAN

Backlash

EXTRACTS FROM CURRENT LETTERS TO THE EDITORS

The Supervisor

Concerning your article, "Supervisors for Tomorrow," (*AM*—Aug 16 '54, p133): God save the Republic!

Let's start with a quotation from Kipling:

"I have six honest serving men.
They taught me all I know.
Their names are what, and why, and when,
And which, and where, and who."

One should know what a supervisor is before one starts training him. Why train a potential executive to be a clerk or a Miss Information?

What is a supervisor? A supervisor is one who leads the activities of men engaged in processing a high-quality product at low cost for delivery on schedule for the purpose of making a profit.

Why is a supervisor? A supervisor is one who, as a part of management, is the direct representative of the owners to the workers.

When is a supervisor? One is a supervisor when one is loyal to his God, his country, and his employer.

Which is a supervisor? The one who thinks about producing more goods for more people at prices they can afford to pay.

Where is a supervisor? He is on the job, seeing that the hundred-and-one instructions of top management are being carried out, and that the morale of his men is high.

Who is a supervisor? One who is healthy, charitable, smiling, content with his lot, and easy to get along with.

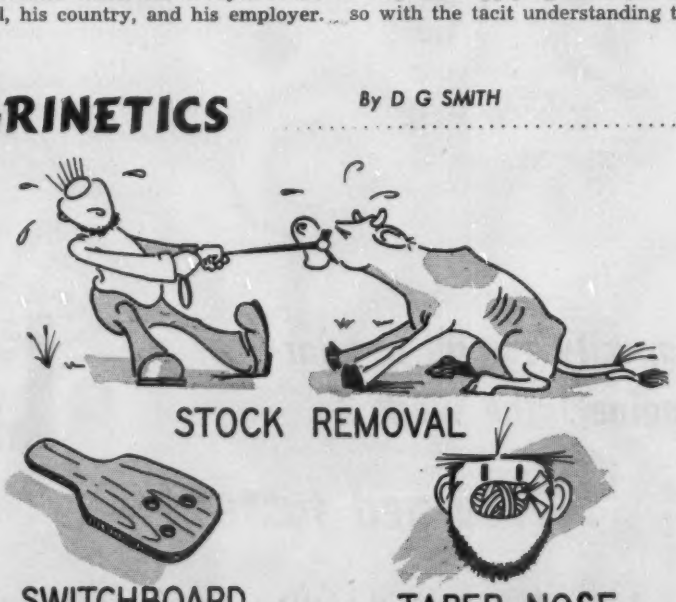
No amount of double-talk can produce an effect greater than its cause. A supervisor is a cause; one which, through the leadership of men, can make a profit for his company.

Leadership is essential to management. Management is no more than the ability to bring out the utmost of capacity residing in the working forces of an organization. Leadership is an elective office. To be a leader, one must know how to get along with people, how to present one's ideas effectively. Human nature is a supervisor's most important problem. A study of the humanities is recommended.

A supervisor with leadership ability must utilize it to make a profit. Every man applying for a job does so with the tacit understanding that

GRINETICS

By D G SMITH



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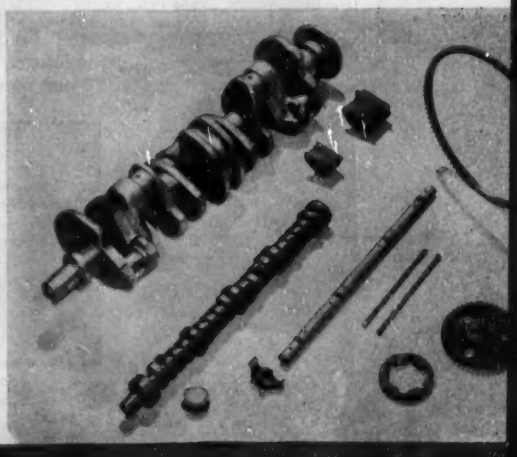
flamatic hardens crankshaft bearings

10/hr. to 70/hr.

It's no wonder the automotive industry turns to **flamatic** for selective heating precision. This machine, for example, provides the flexibility for development work on a variety of crankshafts or small lot production up to 10 parts/hour, simultaneously hardens main and pin bearing diameters in one operation. Interchangeable flame heads, adjustable flame head holders, and movable tailstock permit quick changes from one size to another . . . Another **flamatic** hardening machine for one size crankshaft hardens 70 parts/hour. Single- or multi-purpose **flamatic** machines have met production requirements on many automotive parts, a number of which are shown at the right. Write for new **flamatic** catalog, Publication No. M-1861.



CINCINNATI **flamatic**

PROCESS MACHINERY DIVISION
THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO, U.S.A.

You have precision

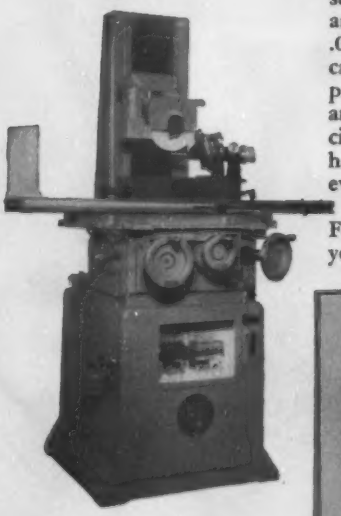
at your finger-tips

when you use REID GRINDERS

Every move counts, with no tiresome reaching or bending, when you operate a Reid. All controls are right at finger-tip level . . . always under your complete control, reacting instantly, without backlash or wheel play.

Such dependable performance, the result of Reid's built-in accuracy, insures precision to meet the closest tolerances. When the shop order reads .0001", put the work on a Reid and you can be sure that the finished piece will pass inspection. Reid Surface Grinders are designed and precision-built by specialists who put the results of over a half-century of experience into their every detail.

Find out the full story on Reid Features for Better Grinding: request your copy of Bulletin 618-15.



Elevating hand wheel, graduated in .0005"
Optional: Vernier, graduated in .0001", for elevating hand wheel
Cross feed hand wheel, graduated in .001"
Power feed (Model 618V), automatic adjustable cross feed from .006" to .100" at each reverse of table.
Table speed, 12-35 feet per minute
Work capacity: 6" x 18"
Table size: 51" x 8"
Standard wheel: 7" x ½" x 1¼"

Reid Brothers Company, Inc.

BEVERLY, MASSACHUSETTS

he can and will help his employer to make a profit. Next to knowing how to get along with people, cost consciousness is most essential to a supervisor. A study of economics is recommended.

I work for a corporation which employs thousands of supervisors. We are subject to a relentless hammering on the importance of leadership and cost reduction. When we talk in our sleep we say, "I gotta be a leader. I gotta get a cost reduction."

The correct processing of material to a desired standard of quality is essential to cost control. In a well organized enterprise this is easy for a supervisor. All he has to know is the telephone number of an authority on the operation in which he is interested. He must be taught not to proceed until he has the necessary information. Of course, the more a supervisor knows about processing, the more of an asset he is to his company. A course in processing and materials is recommended.

A production schedule is also important. However, modern industry is organized on a line and staff basis. Production clerks keep the supervisor posted on the progress of his work. A supervisor should be taught the importance of gaining a customer's goodwill by making deliveries on schedule. One who is familiar with the operations in the departments preceding and following his own can be a big help in expediting work in process. A knack of getting along with people comes in handy here. Again we recommend a study of the humanities.

Quality control is important from a cost standpoint. Excessive quality is a waste of money. Poor quality is a waste of time. Common horse sense, which seems to have departed with the horse, is needed to maintain a happy medium in quality control. A knowledge of quality control is recommended.

Mental and physical health is of tremendous importance to a supervisor. Many do not appreciate this. Tell it to them early and often.

A sense of humor in invaluable. A supervisor must know how to laugh at himself. He must know how to make his men laugh with him, not at him. Many an embarrassing situation can be salvaged by a supervisor laughing at himself. Development of a sense of humor can be worked in as a sideline in an effective presentation course. This is recommended.

Medical and physical health is of tremendous importance.

Loyalty is inherent in leadership. A man loyal to his God will never degrade the nature, nor injure the dignity, of his fellow man. A man loyal to his country will always act like a good citizen. He will be an example to those under him. He will obey the law, pay his taxes, and vote in every election. A man loyal to his employer will give him an honest day's work and insist that others do the same. If he cannot sell his company to all his friends and assocates he will quit. A course in good citizenship is recommended.

Training a supervisor may seem like a difficult task. Such is not the case. The simplest way to train a supervisor is to have him follow the discussion in the Round Table section of AMERICAN MACHINIST.

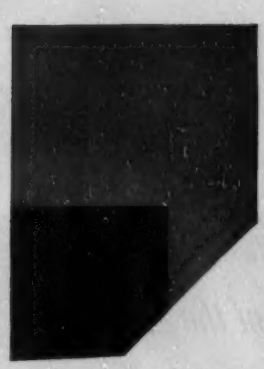
Peter A Seward
Swampscott, Mass

SPLITS

I wish your editors would not be so terribly afraid of splitting an infinitive that they hesitate to split other parts of a verb. Why say "Parts easily can be fitted," when it reads better, and is actually more correct to say, "Parts can easily be fitted," or, "Parts can be fitted easily?" And remember that even a split infinitive is permissible at times.

H Westcott
Miami, Fla

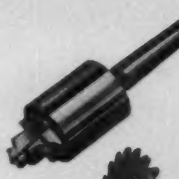
for Special Service on Carbide "Specials"

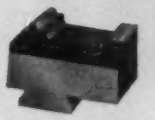


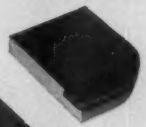
GORHAM

GORHAM

GORHAM



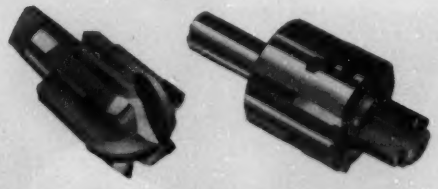




When your production machining problem dictates the use of special carbide tooling, your nearby Gorham Field Engineer can give you the right answers fast! He's an expert in the design and application of special cutting tools . . . and he provides a complete engineering service to determine your exact requirements.

He begins with your product, sketch or idea. He surveys your production operations and available equipment. He considers work material properties and required finishes and tolerances. He plots speeds, feeds and methods of tool driving. Then he develops practical design and metallurgical specifications for a special tool that's "tailor-made" for your application. And his recommendations are backed by Gorham's more than thirty years' experience in the design, manufacture and heat treatment of fine cutting tools.

Yes, your nearby Gorham Field Engineer is a helpful man to have around! If you haven't yet met him, write for his name, or send details of your problem direct, and we'll have him get in touch with you promptly.



Gorham TOOL COMPANY

"EVERYTHING IN STANDARD AND SPECIAL CUTTING TOOLS"

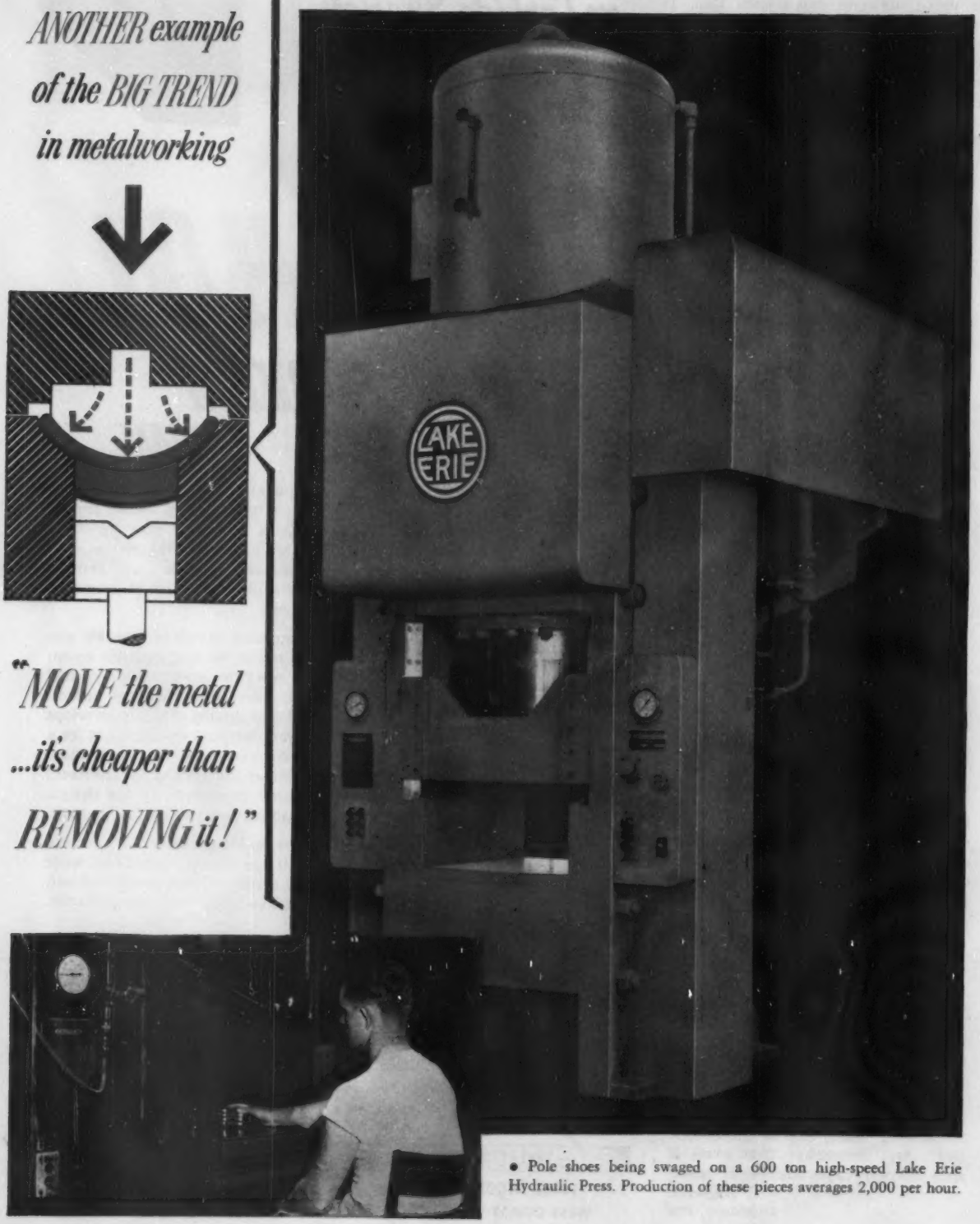
14408 WOODROW WILSON • DETROIT 3, MICHIGAN

WEST COAST WAREHOUSE: 576 North Prairie Ave., Hawthorne, Calif.

COLD-FORMING

ANOTHER example of the BIG TREND in metalworking

"MOVE the metal ...it's cheaper than REMOVING it!"



• Pole shoes being swaged on a 600 ton high-speed Lake Erie Hydraulic Press. Production of these pieces averages 2,000 per hour.

PAYS OFF 4 WAYS!

A major producer of automotive parts and electrical systems reports:

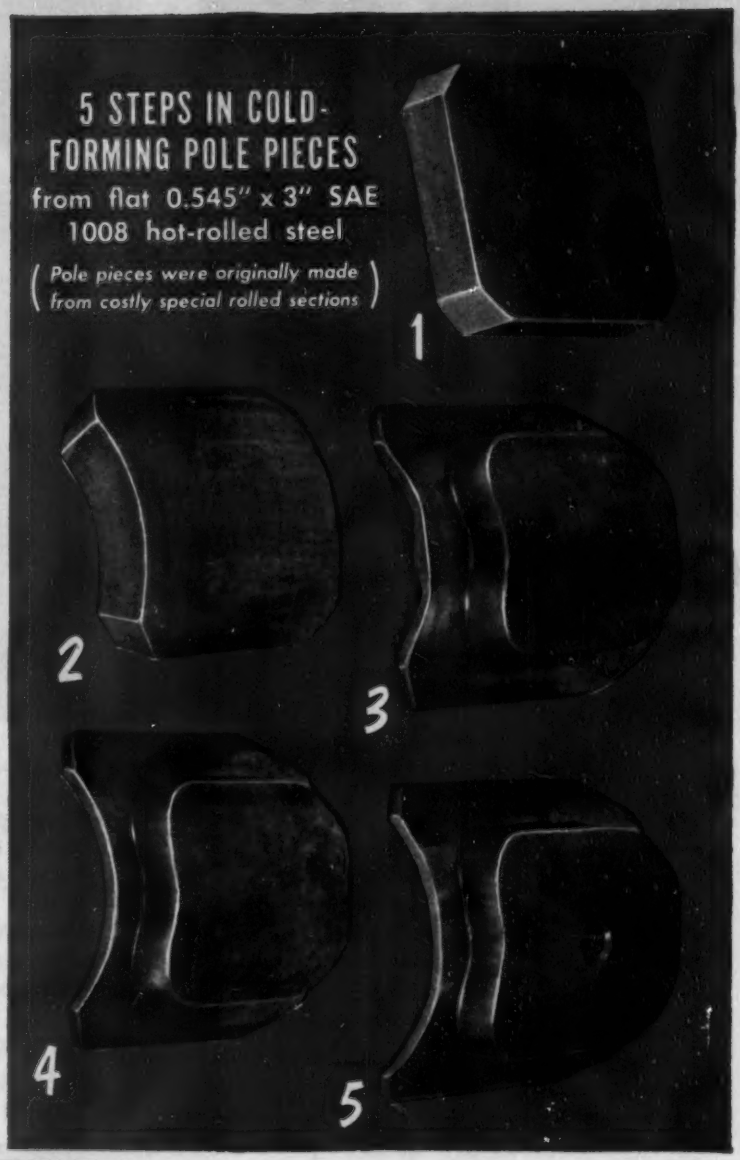
1. MATERIAL SAVINGS
of 50% or more common in production of automotive parts.

2. LOWER TOOLING COSTS
because special-purpose machines are eliminated.

3. DELAYS AVOIDED
in starting production.

4. HIGH PRODUCTION RATES
are realized with cold-forming processes (sizing, swaging, coining and extruding).

The big trend in metalworking today is to press metal into a desired shape rather than to shape it by machining. This results in new and better products at lower cost. These new processes include cold "pressure" forging of aluminum, cold extrusion of steel, and high pressure closed die extruding of aluminum, brass and other non-ferrous alloys. Also falling within this category are somewhat older though greatly changed and improved methods for the extrusion of aluminum, hot forging of ferrous metals, powder metallurgy, deep drawing of sheet and die casting. These new and improved production techniques are already saving millions of dollars in materials and production time. Lake Erie engineers are in the forefront of these developments. They will be glad to explore applications in your production. No obligation. Call us.


5 STEPS IN COLD-FORMING POLE PIECES
from flat 0.545" x 3" SAE 1008 hot-rolled steel
(Pole pieces were originally made from costly special rolled sections)
1
2
3
4
5

LAKE ERIE
HYDRAULIC PRESSES

LAKE ERIE ENGINEERING CORP.
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HYDRAULIC PRESSES • DIE CASTING MACHINES
ROLLING MILL AUXILIARY EQUIPMENT
LAKE ERIE®

Straightens Steel Castings

40% Faster

Elmes Open-Side Press in plant of Maynard Electric Steel Casting Company, Milwaukee, producers of electric furnace steel castings.

Look to Elmes for press performance at its best!

The Elmes 250-Ton Hydraulic Open-Side Press shown in photograph is used for straightening castings ranging from 50 to 4000 lbs. The Maynard Electric Steel Casting Company reports that this Elmes Press is 40% speedier than the presses previously used, and also is more accessible and more economical to operate.

This is but one of many types of hydraulic metal-working presses produced by Elmes—but the customer report is typical in its praise of Elmes' craftsmanship in press design and manufacture. For all kinds of standard or special-purpose metal-working press applications, you'll be time and money ahead if you rely on Elmes Presses to do the job. Elmes Presses—whatever the type—bring you important performance economies. Elmes *Pipeless* Hydraulic Presses, which reduce costly down-time, give you *even greater* savings. Why not look into the many advantages offered by Elmes Hydraulic Metal-Working Presses? Individual recommendations and cost estimates will be supplied promptly on request.

WRITE FOR ELMES BULLETIN 1010-B

Illustrates, describes, and gives major specifications on complete line of Elmes Hydraulic Metal-Working Presses.

American Steel Foundries

ELMES ENGINEERING DIVISION

1141 TENNESSEE AVENUE CINCINNATI 29, OHIO

METAL-WORKING PRESSES • PLASTIC-MOLDING PRESSES • EXTRUSION PRESSES • PUMPS • ACCUMULATORS • VALVES • ACCESSORIES

Spot News of Metalworking...

- **AUTOS FOR SOUTH AFRICA...**

  Formation of a national automotive parts manufacturers association in South Africa may be the first step towards complete manufacture of cars there. Parts makers claim they can match overseas quality and that now all they need is (1) an auto body plant, and (2) permission to import automated machinery to step up output.

- **FOUNDRY OUTLOOK...**

  Quizzed as to whether 1955 foundry business will be better than 1954's, 100 top foundrymen meeting in Cleveland see it this way: poor, 1; fair, 50; good, 47; very good, 2. As to 1955's general business conditions: 3 expect worse than in 1954, 36 say about the same, 57 say better, 4 say much better.

- **TITANIUM RESEARCH...**

  Battelle Memorial Institute, Columbus, will undertake titanium research for the Defense Dept covering: (1) heat-treating sheet and bar stock, (2) new standards for purity and hardness of titanium sponge, (3) effects of hydrogen on titanium at elevated temperatures, and (4) design criteria for fasteners.

- **OPTICAL COMPARATOR CHARTMAKING...**

  Complete set of tooling for producing optical comparator charts directly, without intermediate layout and photographic reduction, is being marketed by an Eastern instruments firm. Unit comprises basic machine and six tools, achieves positioning better than 0.003 in. over 24 in, holds angles to 2 arc minutes.

- **SMALL BUSINESS AND THE AIR FORCE...**

  Aircraft Parts Manufacturers' Association, Los Angeles, is urging the Air Force to award 25¢ of every contract dollar to small manufacturers, claiming about 12% of the West Coast's 4000 small airframe and aircraft component makers are forced to seek other fields—a situation that could "precipitate a dried-up source condition" if major companies again have to make an all-out production effort.

- **LABOR DISTRESS AREAS...**

  Although the government has released a flood of new contracts for military hard goods (see p182), only one such contract—$36.4 million to Western Electric at Charlotte, NC, for production of the Nike guided missile—has been awarded in a critical labor distress area.

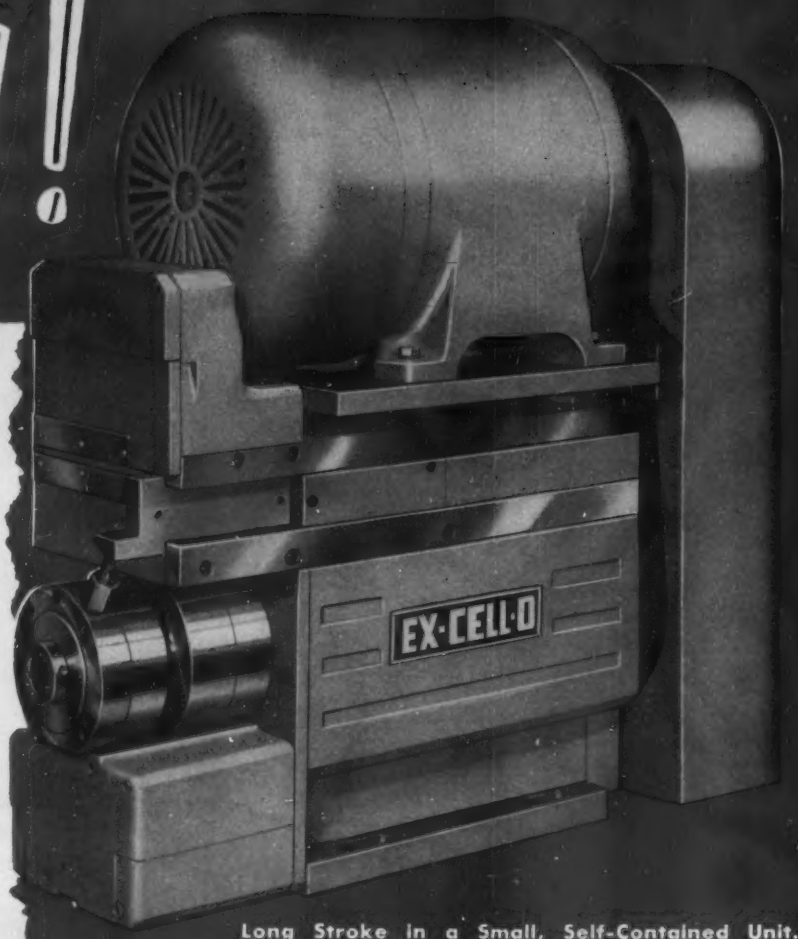
- **7000-MPH PLANES...**

  Sustained aircraft speeds up to 3000 mph at sea level and up to 7000 mph at 185,000 ft are predicted by a Douglas aircraft designer. He says the so-called "heat barrier" at these speeds has already been overcome by new materials that won't creep and deform at terrific speeds.

NOW!

The NEW LONG STROKE Style 22 Hydraulic Power Unit

XLO



Long Stroke in a Small, Self-Contained Unit. Ex-Cell-O Style 22 quill-type Hydraulic Power Unit. Capacity, 3 HP; stroke, 8". Style 22-L, 12" stroke.

For special-purpose machines at low cost use these Ex-Cell-O quill-type hydraulic power units to feed, rotate, and retract tools for drilling, reaming, counterboring, and spot-facing.

See your local Ex-Cell-O representative, or write Ex-Cell-O for literature.

IMPORTANT FEATURES

1. Long Stroke in small rugged unit.
2. Flexible automatic cycles.
3. Two infinitely adjustable feed rates.
4. Hydraulic pump externally manifold mounted.
5. Electric and manifolded hydraulic controls enclosed, yet readily accessible.

EX-CELL-O CORPORATION DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

54-31

Washington . . .

The President's new highway program could eventually push construction machinery business up as much as $400 million annually, assuming other building doesn't taper off. The program—a $50-billion, 10-year project—is aimed to double the normal rate of highway construction in this country.

Present highway spending for construction is about $4 billion yearly, with Washington supplying only about $600 million, local governments and bond buyers the rest. The new program would be on top of this, would boost the total to $9 billion. Experts think it may be three years before the boom trickles down to the equipment manufacturers, however. Though this is the ninth consecutive year that the construction industry has set a new record for volume of work put in place, many contractors still have idle equipment. Besides, most dealers are fully stocked and manufacturers are producing at only partial capacity.

• • •

ODM has mapped out the administration's $900 million Stockpile Buying Program for the next nine months, has shown that what was once a single stockpile with only one purpose—defense—is now really three different stockpiles, each with different functions—defense, metals market propping, and a means to get rid of surplus farm goods.

The original stockpile, now called the "Minimum Program," covers 76 materials. At last count, total value of objectives was almost $7 billion, of which roughly 80% was on hand or order. Thirty-six goals have been reached, 14 are still less than 50% along. About $145 million will be spent during fiscal 1955 on direct purchases for the program, about $400 million to write off acquistions under government floor-price purchase commitments on aluminum, copper, and other metals, made as a spur to expansion after Korea.

The second or "long-term" stockpile discounts wartime sources of supply outside the Western Hemisphere (and maybe North America). Actually, the bulk of metals and minerals originally scheduled for stockpiling were those produced mainly overseas. Idea was to lessen wartime dependence on foreign sources by piling up supplies in peacetime.

Most of the remaining $355 million will presumably be used to buy lead, zinc, antimony, and manganese in this country under this plan. Real objective is to give ailing US miners a shot in the arm. Right now, the government plans to buy half of 1955 US lead-zinc output.

• • •

Justice Dept is holding up Dow Chemical's bid to buy the government-owned Velasco, Tex. magnesium plant. It claims the proposed purchase might violate anti-trust policy. Justice says the deal would bolster Dow's position in light metals. Dow operates the 15,000-ton plant—the only government plant in production—on a lease that expires this month. Dow wants to buy the plant instead. GSA, which runs the plant, backs up Dow's purchase offer.

Dow argues that it's the sole magnesium producer now only because other firms have been unwilling to invest in the field. Besides, says Dow, since magnesium is so hotly competitive with aluminum, monopoly talk in light metals doesn't really mean much.

• • •

FOA's multi-million dollar machine-tool buying program has dwindled to just about nothing. About all the agency is buying these days is small tools for use as vocational training equipment on overseas technical assistance missions. Only machinery being bought on large scale is construction and farm equipment and special types of motor vehicles. Some production equipment will still be bought with FOA money through the Defense Dept for military assistance missions, but this program isn't firmed up yet.

One big FOA project now under way is to screen lists of excess US government property for possible overseas shipment as economic aid. Officials emphasize, however, that the policy is not to ship machine tools abroad.

• • •

Navy has agreed to buy and install $5 million worth of heavy aluminum forming and shaping machinery at Reynolds Metals Co. plants at McCook, Ill, and Phoenix, Ariz. Equipment will be used to fabricate wing panels and other heavy jet aircraft structural parts, and includes a 7,500-ton aluminum plate stretch leveller, two large aluminum skin milling machines, a 6000-ton aluminum extrusion press. Navy says considerable transportation costs will be saved by locating precision milling and other tools at the source of the heavy plate.

• • •

The government's most sensitive barometer, showing levels of unemployment, centers in manufacturing. Watch the results of unemployment insurance tabulations. Right now, there's a new trend downward after a 100% rise during the first six months of 1954.

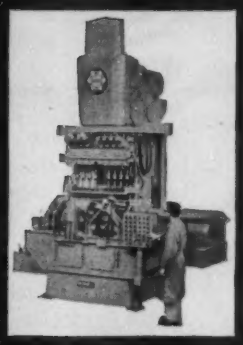
Factory workers comprise a major part of the three-point survey. The latest figures show that claims for jobless benefits filed by newly unemployed are down below 250,000; those collecting weekly benefits total 1.6 million—the lowest so far this year; those who have used up benefits are also falling.

FOR

Production • Accuracy • Economy

V-8 Cylinder Blocks are MICROHONED Automatically on NEW Model 420 Hydrohoners ☆

Specifications of this model are included in our general catalog—obtainable at the offices listed below.



This multiple-spindle, heavy-duty model is designed to fit any type of production line. Examples of its adaptability: above, two four-spindle machines with tip-up fixtures; left, V-type; upper right, eight spindle vertical.

1929 • 1954 — PRECISION PRODUCTION THROUGH MICROHONING — MICRO MATIC — 25TH YEAR OF DEVELOPMENT

MICROMATIC HONE CORPORATION

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MICROMATIC HONE CORP.
MICRO-MOLD MFG. DIV.
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REPRESENTATIVES: Allied Northwest Machine Tool Corp., 103 S.W. Front Ave., Portland 4, Oregon • Mason Machine Tool Company, 415 So. Second East, Salt Lake City, Utah • Tidewater Supply Co., Charlotte 4, North Carolina

REPRESENTATIVES IN ALL PRINCIPAL COUNTRIES

SUBSIDIARY:

Micro-Precision Inc., 2205 Lee Street, Evanston, Illinois

Hydraulic Controls • Diesel fuel injection equipment

Trying to unravel the Plymouth engine program is one of the more baffling little posers of the new model season.

The company is not talking even on an off-the-record basis about its '55 engine program, presumably because it wants to be absolutely sure about the horsepower ratings Ford and Chevrolet will advertise for '55.

It's known that Plymouth originally planned to claim 150 brake horsepower for its V-8, but that figure seemingly is out the window now. As nearly as can be determined, without any clues from the company, this is the program:

Initial '55 Plymouths will be powered by a V-8 that is basically Dodge's 1954 Red Ram, unchanged in any major respect except for cylinder heads. Later in the '55 production run, Plymouth will switch to Dodge's '55 version of the Red Ram. The basic '54 Red Ram will continue to be used in Dodge trucks (AM, May 24 '54, p101).

In the meantime, Plymouth has budgeted $39 million to tool another V-8 that will be Plymouth's exclusively in 1956 models.

• • •

The motif at the press preview of the 1955 Chevrolets was "there is something new under the sun."

The advertising agency responsible for that was referring to the new cars. But Chevrolet General Manager T H Keating offered something new in manufacturing terminology: segmented automation.

Keating's definition: "By 'segmented automation' we mean, very simply that Chevrolet intends to keep major segments of a line running, in case of breakdown anywhere along the line. This has been a major problem in the development of automation.

"**Some manufacturers** can let a whole line go down, while servicing a single segment, and tolerate such interruptions, for repairs. Chevrolet's volume is too great for that. Major segments of all our lines must be kept running. Any segment of a line, temporarily shut down, must be flexible enough to put on an extra shift and catch up after the shutdown is over."

Keating coined the word to describe Chevrolet's new Livonia (Mich) spring and bumper plant. That plant, he said, will have segment automation step-by-step through the spring fabrication sections of the plant; also, segmented automation from raw material through the automatic plating process in the bumper manufacture section.

Another executive introduced more new phraseology.

George Romney, new chairman, president and general manager of American motors, succeeding the late George Mason, said that AMC hopes to develop "product reciprocity" with competing companies.

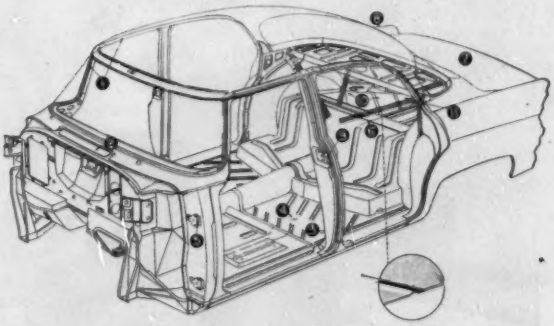
By product reciprocity, Romney meant the sale of automotive and appliance components between one company and another. Examples: AMC sells heater controls and refrigerator inner doors to General Motors and Frigidaire, and buys Hydra-Matic, other items, from GM.

Looking ahead, product reciprocity may develop importantly between AMC and Studebaker-Packard. The latter will furnish V-8s to AMC, and Packard's automatic transmission is a likely candidate for future installation in Nash and Hudson cars.

Romney said AMC will realize savings of millions of dollars by consolidating production of Nash and Hudson, building bodies with common dies and tools (although only one exterior panel on Nash and Hudson will be identical), eliminating 17 parts warehouses, other economy moves.

He denied again that merger talks with S-P are now or have been in the works, either directly or through an intermediary. But he did not specifically rule out the possibility of future consolidation with S-P.

Production of the Chevrolet Corvette, once up to nearly 1000 units a month, is trickling along now at a mere 50 a month. Expectations in the trade are that the 1955 Corvette and the Ford Thunderbird will breathe some new life into the tottering US-built sports car market.



Chrysler's New Style

BODY CHANGES INCORPORATED INTO ALL CHRYSLER MAKES in the 1955 models include: (1) wrap-around windshield, (2) high-level cowl ventilation, (3) stiffened floor panel, (4) additional body mounts, (5) three-way (up and down, in and out, forward and back) door hinges for exact door fitting, (6) new body sealing for all metal-to-metal lap joints, (7) torsion-bar-balanced rear deck lids, (8) gas tank filler located at right rear fender, (9) self-tightening rotary door latches, (10) reinforced diagonal back braces behind rear seats, and (11) adjustable rear door vent wings to control movement of air

How complete is "complete"?

Motch & Merryweather builds circular sawing machines which cut off stock up to 43" diameter, ferrous or non-ferrous (titanium to magnesium) –rounds, squares, or structural shapes.

Model No. 5 High Speed Type, for non-ferrous stock through 43" dia.

Fifty Years 1904 • 1954

m 1/4" all the way up through 43"

Model No. 00-A for solid stock 1/4" through 1-1/4" diameter.

Using the Triple-Chip method, Motch & Merryweather circular sawing machines cut off stock faster and more economically than does any other method. We offer you not only a complete line of machines, but complete service after the sale. Only Motch & Merryweather builds all three—the Triple-Chip saw blade, the circular sawing machine which uses it, and automatic blade sharpeners to sharpen and re-sharpen at low cost.

THE MOTCH & MERRYWEATHER MACHINERY CO.

MACHINERY MANUFACTURING DIVISION
CLEVELAND 13, OHIO

Builders also of Production Milling, Vertical Turning, Automatic and Special Machines

Machine Tools . . .

Not content with its supremacy in the US automotive field, General Motors has set out to make its position stronger in Britain and on the Continent.

It intends to spend a tidy sum ($185 million) enlarging its facilities for making and assembling cars in western Europe.

More than half the money will go into increased capacity at Vauxhall, GM's big British subsidiary.

The entire program will be a windfall for machine tool builders. It is a good bet that German builders will get a healthy number of orders.

Vauxhall alone will make an outlay of around $50 million for new production equipment, it is believed.

A brand-new press shop is at the head of the list of expansion at Vauxhall. A large order for presses for this shop already is in the hands of a British subsidiary of a US company.

Equipment to be bought will include transfer-type units. Much of this business will go to German builders, according to reliable reports. The Germans are ready and eager to take on the assignment and will be nursed along by engineering help from Vauxhall.

If the transfer-type units are allotted to the Germans, it will be because British companies have been lukewarm about tackling the building of these complicated "specials."

British builders nevertheless will get a substantial share of the Vauxhall tooling program. Vauxhall wants to buy as many machine tools as possible at home.

US builders will receive some orders from Vauxhall. But the orders will be concentrated in the hands of a few builders making types of machines not otherwise available in England.

• • •

Opel also has an expansion program that calls for machine tool purchases on an impressive scale. Most of the money will be spent with German builders. But, as in the case of Vauxhall, some nice orders are destined for US builders too.

General Motors is not alone in pouring funds into enlarging its manufacturing and assembly operations in western Europe.

Native British automobile companies also are embarking on plant enlargements. Volkswagon in Germany is doing the same thing.

All companies are banking on a much bigger automobile market at home and abroad. Most European car makers export at least half of their output.

Clearing Machine Corp has been acquired by Pressed Steel Car Co Inc at a cost of $9,850,000, of which $5.3 million will consist of new convertible debentures and the balance of cash.

Pressed Steel Car also owns Axelson Mfg Co, Los Angeles, maker of heavy-duty engine lathes.

The Clearing purchase makes Pressed Steel Car a major factor in the machine tool business, the latter's president John I Snyder Jr asserts.

Mr Snyder refers to the machine tool business as having "more dynamic force than almost any other factor in industry."

For further details on Pressed Steel Car's purchase of Clearing, please turn to page 178.

• • •

Rumors are going the rounds about possible purchases of machine tool companies by individuals and groups both outside and inside the industry.

Frederick Richmond's recent activities, in buying Birdsboro and Follansbee Steel and in attempting to acquire Hydraulic Press Mfg Co, have sparked stories about other companies in the machine tool field upon which he looks fondly.

One story has it that an individual or group of individuals is trying to get control of a well known machine tool company by buying its stock on the open market.

• • •

In pursuit of diversification and a larger share of the market, several machine tool builders are about to announce types of machines that they heretofore have not made.

One builder, to be specific, is about to enter the small, low-priced engine lathe market with a line of machines. Another builder intends to reveal shortly a reciprocal surface grinder, a kind of machine that it has not manufactured before.

• • •

Builders not entering new markets are doing major redesign jobs on existing models. Improvements will be so great that the new machines will be *new* machines and not merely reflect a few minor changes.

One New England builder will show to the press its redesigned lines early in November. A midwestern builder has a similar press preview scheduled for November too.

Cincinnati Milling has many new machines to offer, including a "Hydrospin" machine. These machines are being shown to customers in connection with the company's 70th anniversary celebration.

C I T Corp is to gear its financial terms on purchases of machine tools and lift trucks to the new faster depreciation schedules in the recently-enacted tax law. The plan makes it possible for a user to pay for a machine at about the same rate at which the machine can be depreciated.

You get more parts per hour

PRODUCTION INCREASED 50%
COSTS REDUCED 11.6%

MACHINE TEST REPORT

Stock Size	-5/8" Hexagon
Part Name	-Hose End Blank
Machine	-1-1/4 RAG Acme Gridley
Machine Operations	-Forming, drilling, reaming
End Tool Slide Com.	-1/2
End Tool Slide Feed	-.0065 for B-1113 -.0075 for MX

COMPARATIVE PRODUCTION

GRADE	RPM	SFM	PART TIME (SECONDS)	GROSS PARTS PER HOUR	PRODUCTION INCREASE (PERCENT)	TOOL LIFE INCREASE (PERCENT)
B-1113	1166	221	6	600	-	-
MX	1536	290	4	900	50	50

***ESTIMATE OF COMPARATIVE COSTS**

	B-1113	MX
Net Production/Hr. at 70% Efficiency	420	630
Hours to make 10,000 parts	23.81	15.87
Direct Labor	$ 22.02	$ 14.68
Machine Overhead @ $2.275 per Mach./Hr.	$ 54.17	$ 36.10
Conversion Cost	$ 76.19	$ 50.78
Material Cost	$142.30	$142.30
Total Manufactured Cost of 10,000 parts	$218.49	$193.08
Saving	$ 25.41	or 11.6%

*Note-These cost figures have been calculated on the basis of current rates for Direct Labor and Machine Overhead and Machine Efficiency, used by a representative screw machine shop.

PRODUCTION INCREASED 51.6%
COSTS REDUCED 17.3%

MACHINE TEST REPORT

Stock Size	-1-1/8" Rd.
Part Name	-Pulley Hub
Machine	-6 Spindle Conomatic, 1-1/4"
Machine Operations	-Rough form, finish form, drill, ream, counter-sink, spin, cut-off

COMPARATIVE PRODUCTION

GRADE	PART TIME (SECONDS)†	GROSS PARTS PER HOUR	PRODUCTION INCREASE (PERCENT)	TOOL LIFE INCREASE (PERCENT)
B-1113	22.9	157	-	-
MX	15.1	238	51.6	51.6

†Estimated.

***ESTIMATE OF COMPARATIVE COSTS**

	B-1113	MX
Net Production/Hr. at 70% Efficiency	110	167
Hours to make 10,000 parts	90.9	60.0
Direct Labor	$ 84.08	$ 55.50
Machine Overhead @ $2.275 per Mach./Hr.	$206.80	$136.50
Conversion Cost	$290.88	$192.00
Material Cost	$280.00	$280.00
Total Manufactured Cost of 10,000 parts	$570.88	$472.00
Saving	$ 98.88	or 17.3%

*Note-These cost figures have been calculated on the basis of current rates for Direct Labor and Machine Overhead and Machine Efficiency, used by a representative screw machine shop.

PRODUCTION INCREASED 29%
COSTS REDUCED 8.0%

MACHINE TEST REPORT

Stock Size	-3/4" Hexagon
Part Name	-Master Cylinder Outlet
Machine	-1-1/4 RAG Acme Gridley
Machine Operations	-Forming, drilling, threading, shaving, turning, cut-off
End Tool Slide Com.	-5/8
End Tool Slide Feed	-.0068 for B-1113 -.0073 for MX

COMPARATIVE PRODUCTION

GRADE	RPM	SFM†	PART TIME (SECONDS)	GROSS PARTS PER HOUR	PRODUCTION INCREASE (PERCENT)	TOOL LIFE INCREASE (PERCENT)
B-1113	942	213	7-3/4	465	-	-
MX	1215	275	6	600	29	29

†Calculated from diameter across corners.

***ESTIMATE OF COMPARATIVE COSTS**

	B-1113	MX
Net Production/Hr. at 70% Efficiency	326	420
Hours to make 10,000 parts	30.68	23.81
Direct Labor	$ 28.38	$ 22.02
Machine Overhead @ $2.275 per Mach./Hr.	$ 69.80	$ 54.17
Conversion Cost	$ 98.18	$ 76.19
Material Cost	$175.50	$175.50
Total Manufactured Cost of 10,000 parts	$273.68	$251.69
Saving	$ 21.99	or 8.0%

*Note-These cost figures have been calculated on the basis of current rates for Direct Labor and Machine Overhead and Machine Efficiency, used by a representative screw machine shop.

at lower cost per part ...when you do the job with MX

*available in Bessemer or Open Hearth**

● You don't have to take our word for it. When we tell you that U·S·S Free-Machining MX will increase your production and that it will cut the cost of any part you now machine from ordinary screw stock, we have the FACTS to back us up . . . production and cost figures that speak for themselves.

In the three years that this high speed, freer-cutting bar stock has been on the market, hundreds of shops have put it to the test. Although the more than a billion parts made with MX have been of infinite variety and have been produced under dissimiliar conditions and on screw machine equipment of different types—the results obtained have been similiar.

Here is what has happened in shop after shop: Output per machine, per hour, per man, has been increased. Time between tool grindings has been extended. Parts finish has been better. Close dimensional accuracy has been easier to obtain. Rejections have been fewer.

And despite its better performance, MX costs no more than ordinary screw stock. Consequently, savings with MX have been invariably recorded. These savings have averaged between 10 and 15%, but also have run as high as 42%. Can you afford to give your competition this edge on you?

Give U·S·S Free-Machining MX a thorough trial. Produced in all the popular screw stock sizes, it is sold in cold-finished form by your regular supplier either as "MX" or under his own identifying trade name. In hot-rolled form MX is available direct through our nearest district sales office.

* To give screw machine operators a freer-cutting steel of the C-12XX type, MX is now also being produced in our Open Hearths. This steel, especially controlled to improve cold-drawing characteristics, assures users a fast-cutting bar stock not only of *excellent* surface quality but one that performs exceptionally well when finish-machined parts require crimping or other deforming operations.

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UNITED STATES STEEL

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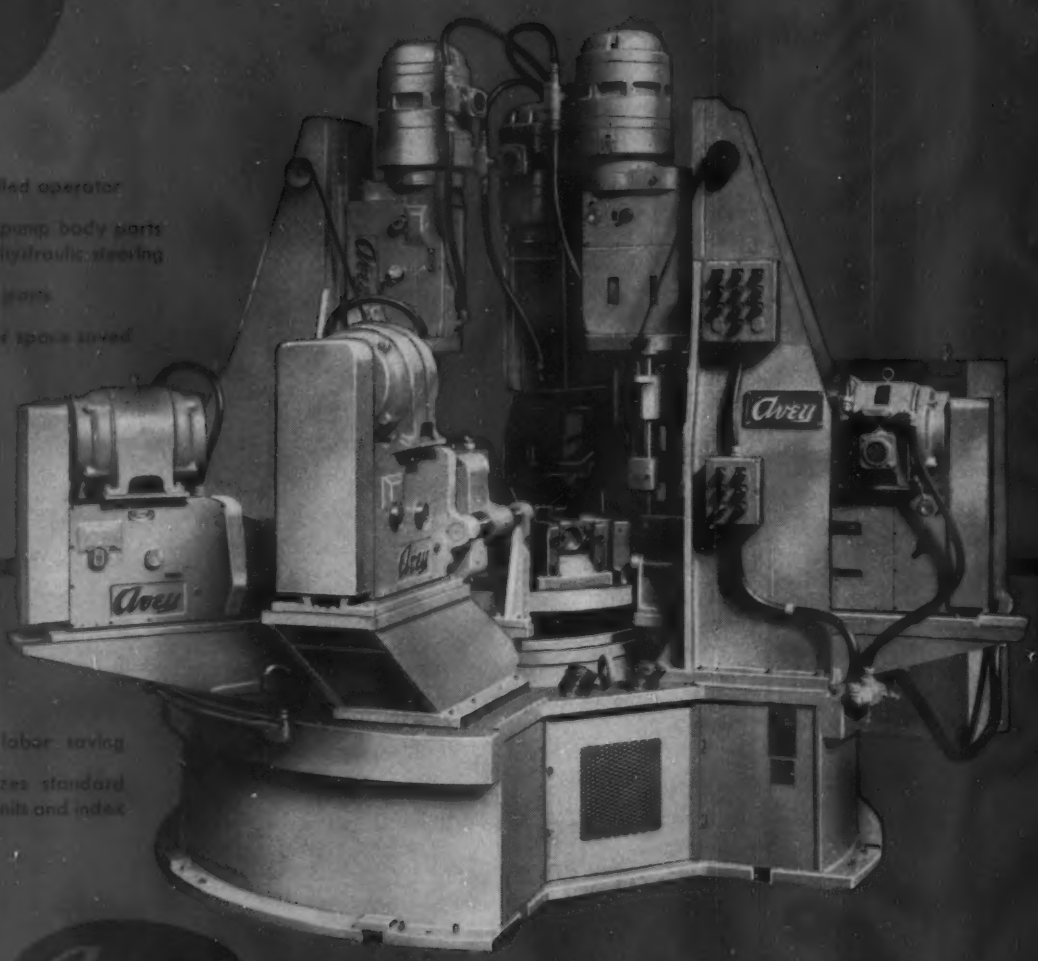
MILLING · DRILLING · TAPPING MACHINE

3 *machines in one...*

MILLS . . . DRILLS . . . TAPS . . .



- One semi-skilled operator
- 80 hydraulic pump body parts per hour . . . hydraulic steering
- Uniformity of parts
- Valuable floor space saved
- High direct labor saving
- Machine utilizes standard Avey boxes, units and index tables

Avey

It will pay you to be up to date . . .
Write for recommendation on your jobs from Avey

THE AVEY DRILLING MACHINE CO., Cincinnati 1, Ohio

Gaging Metalworking . . .

PRODUCTION INDEX
BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

	SEPT '54(*)	AUG '54(p)	JULY '54(r)	AUG '53
Tot. Index...	**147**	**148**	**148**	**171**
Machinery	**128**	**126**	**145**	
Electrical Machinery	**180**	**173**	**203**	
Autos	**98**	**100**	**125**	
Other Transportation	**285**	**290**	**307**	
Other Metalworking	**126**	**126**	**144**	

(*) Estimated (p) preliminary (r) revised

General metalworking picture is somewhat spotty at the moment, with most industries more or less marking time in anticipation of a fourth quarter upswing.

• • •

In the tool and die industry, Detroit shops are still at a high operating rate, but they expect a slackoff soon as the automotive industry winds up its '55 tooling.

Midwestern tool and die men report little change in recent weeks. Atlantic Seaboard shops, however, are pretty hard hit, with the exception of Connecticut.

One thing that is worrying the tool and die people: keen competition among shops that have no backlogs. They're taking orders at suicide rates to keep going.

• • •

Automotive parts people are feeling much better these days—the auto builders are starting to release orders in fairly large quantities.

Some 21 Cleveland-area parts plants are recalling workers furloughed as long ago as last May. Activity is centered around shops that make parts for the Big Three, but there's also a step-up in work for shops supplying the independent car builders.

This increased activity is expected to carry on through the balance of this year and well into the next.

• • •

Aviation parts makers report continued high operating levels in the East.

But on the West Coast, some parts makers have a different story to tell. Companies depending solely on defense orders are particularly alarmed. One aircraft component maker, formerly almost exclusively in defense business, is retooling for a non-defense line.

Another West Coast defense manufacturer puts it this way, "We have no new orders and there's no outlook for additional orders. Our backlog is down 10-15% from the first quarter and will be reduced further in the fourth quarter. Fourth quarter production will be down 25-30% from the first quarter."

• • •

But most West Coast metalworking firms peg the fourth quarter as "about the same" as the third quarter. And one office machine maker reports his business jumped 10% over the last quarter.

• • •

Steel output is stepping up. The reason: Detroit orders are coming through, and other customers have exhausted their inventories.

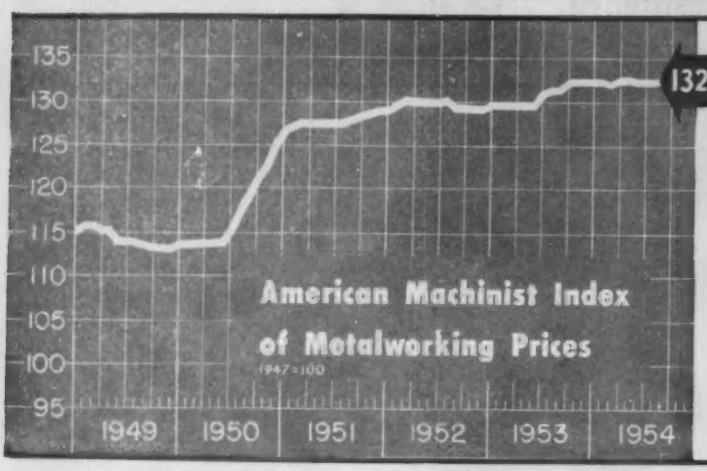
Delivery time on some steel items is now set at 5-6 weeks. But that's about as far as it will get before mill owners start reactivating idle capacity.

Wire and wire products haven't felt the step-up as yet—no bulge there as compared to sheet and strip. But that's to be expected. Wire products are usually the first hit by a slump, and the last to recover.

• • •

Railway rolling stock manufacturers are just about holding their own, with no situation change in the last several months. Passenger car plants still have some work, but only enough to keep them going through year's end. The railroads just aren't buying anything they can do without.

Gaging Business . . .



PRICE INDEX

	SEPT '54(*)	AUG '54(p)	JULY '54(r)	AUG '53
Total Index	**132.7**	**132.6**	**132.4**	**132.1**
Metalworking Machinery	**141.6**	**141.6**	**140.9**	
Other Machinery exc. Electrical	**137.4**	**137.3**	**136.4**	
Electrical Machinery	**131.0**	**131.0**	**130.7**	
Fabricated Metal Products	**129.9**	**128.7**	**128.8**	

(*) Estimated (p) preliminary (r) revised

The August-September period was one of contradictions, with some industries booming along at a great rate, others not doing so well.

Construction activity, for example, continues at an all-time high. The value of work put in place in September was $3.6 billion—8% higher than for September 1953.

So far this year, construction is running about 4% ahead of a year ago. It would do even better if the red tape in processing loan applications could be unsnarled.

Manufacturers' new orders also swung over to the credit side of the ledger in August, when overall new orders rose 1% and durable goods orders increased about 3%. Appliances can take a lion's share of the credit for the upswing in durable orders.

But on the debit side of the ledger, automobile output stayed at a very low rate during the August-September period—marking time until the '55 models come out. Auto dealers' new car stocks are estimated at about 450,000 units—lowest they've been in 15 months. The record for this year was 678,000 units in May.

• • •

On the surface, employment has been steady for the last three months. But if you take a closer look, you'll find that farms jobs increased by 732,000 in September, and non-agricultural employment dropped off 732,000.

While unemployment reached the lowest point in seven months in August, it is feared that the number of unemployed in industry will grow in the next few months. Reason: industrial activity isn't rising fast enough to compensate for increases in the US labor pool and in output-per-worker.

• • •

Total US exports in August amounted to $1.177 billion—a drop of only $10 million from August 1953. Military aid shipments fell off by $72 million from 1953 levels, indicating that regular commercial export shipments were up during the year.

WEEKLY BUSINESS INDICATORS

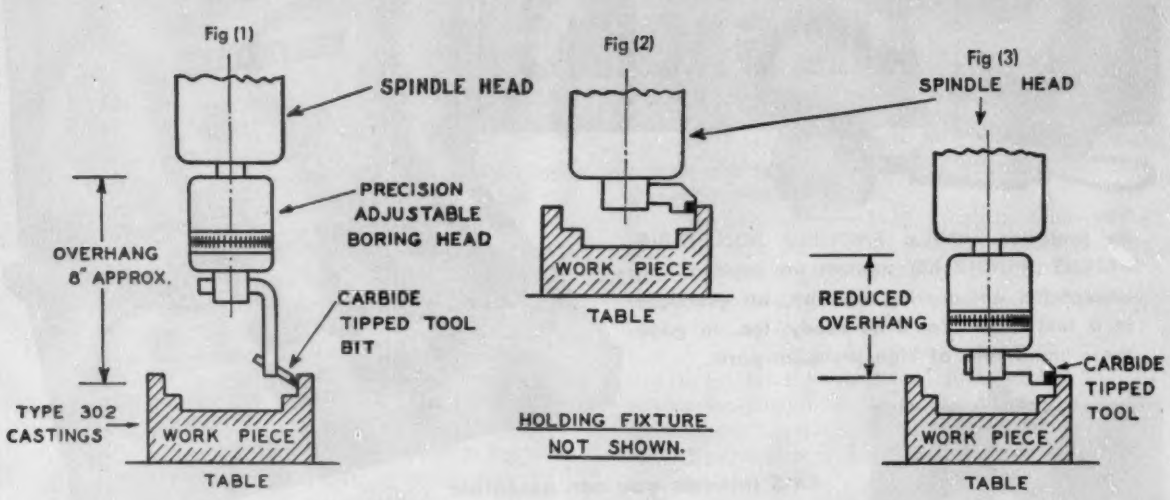
	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1947-1949 = 100)*	122.3	122.4	130.7
Steel ingot operation (thousands of tons)	1,724	1,692	2,172
Electric power output (million Kilowatt hours)	9,193	9,158	8,307
Production of automobiles and trucks	82,757	84,110	148,779
Engineering construction awards (*Eng. News-Record*—millions)	$259.4	$192.9	$233.9

MONTHLY BUSINESS INDICATORS

	Latest Month	Preceding Month	Year Ago
Index of industrial production (1947-1949 = 100)*		124	133
Index of durable manufactures production (1947-1949 = 100)*		135	152
Durable goods manufacturers' sales, millions*	$11,036	$11,287	$12,730
Electrical machinery manufacturers' sales, millions*	$ 1,275	$ 1,318	$ 1,438
Other machinery manufacturers' sales, millions*	$ 1,892	$ 1,920	$ 2,099
Durable goods manufacturers' new orders, millions	$ 9,971	$ 9,700	$10,139
Electrical machinery manufacturers' new orders, millions	$ 949	$ 1,002	$ 1,134
General machinery manufacturers' new orders, millions	$ 1,672	$ 1,612	$ 1,676

* Seasonally adjusted

For good finish watch tool overhang *says Stainless Sam*



Problem:

Poor finish on a boring job. Work done on a vertical milling machine, using tooling shown in Figure 1. The part was a stainless steel Type 302 casting.

Solution:

Stainless Sam gave the tooling set-up one look and saw that it lacked rigidity. Moreover, the tool was too light. So he made these two recommendations to solve the finish problem:

1. If work can be finished in one operation and volume justifies, secure or make a heavy stub boring bar having minimum overhang from spindle (Fig. 2) and fit it with heavy-shanked carbide-tipped tool. For one-pass volume work this is the best set-up, or . . .

2. Eliminate the 4-inch long boring bar and light ¼-inch square carbide-tipped tool (Fig. 1). Instead use a 1-inch square carbide-tipped tool ground down to fit the adjustable boring head (Fig. 3). This will lower spindle overhang to about 4 inches, yet permit roughing and finishing cuts through quick and easy tool adjustment.

• • •

The latter was the set-up that was adopted. It worked with good success.

Stainless machining problems have their answers. Many of them are discussed at length in Armco's latest edition of the booklet, "Machining of Armco Stainless Steels." Write for your copy today. Speeds, feeds and tooling recommendations will help you machine stainless steels readily with standard equipment.

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Be protected with a SHEFFIELD ADJUSTABLE BALLJET SPINDLE KIT against an accident, an unexpected engineering revision, an oversight in a tool order. You'll be ready, too, to gage those small runs of high precision parts.

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In 5 minutes you can assemble from the Kit a spindle for any size within a range of one to three inches and set it to size with the Size Setting Gage. Four spindles of various sizes can be placed in use simultaneously.

NO MASTER SETTING RINGS NEEDED

Standard Calibrator

To assemble and use these spindles, you need only an air gage and the equipment illustrated in the Kit plus a set of standard gage blocks—nothing else—not even one master setting ring. The air gage is calibrated by using the standard calibrator illustrated.

PLAY SAFE—have the Adjustable Spindle Kit on hand for daily use and ready for that emergency which may happen tomorrow.

Call your local Sheffield representative or write for Engineering Data Sheet 119-54. ***Gage Division, The Sheffield Corporation, Dayton 1, Ohio, U. S. A.***

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MASTER CRAFTSMAN SHEFFIELD HEADQUARTERS

SHEFFIELD

American Machinist

MAGAZINE OF METALWORKING PRODUCTION ★ ESTABLISHED 1877

How Long Can the Cycle Last?

A friend of ours got a whopping bill the other day for some work done at his home.

The total invoice ran to $520. And more than 70% of it was for labor.

No wonder home-owners spend their spare hours doing their own repairing or go in for automatic home appliances in a big way.

Our friend resented footing the bill to keep carpenters living in what he described as "the luxurious manner to which they have become accustomed."

What the carpenters don't know or realize is that they are rapidly working themselves out of jobs as their hourly rates rise closer and closer to a prohibitive level. Either the work that they do will gradually fade away, merely because the customer can't afford it, or some way will be found to do the job mechanically.

This sort of experience is happening more and more to home owners. But it is an old story to industry and especially to Metalworking.

Labor rates have been pushed up year by year. On top of them have been piled fringe benefits to make the total labor cost even higher.

No end is in sight to this relentless upswing. The average hourly rate in Metalworking is now at an all-time high. And each year the rate is nudged just a bit higher. No doubt another new peak will be reached in 1955.

This upsweep in hourly rates can be justified on only one condition—that each worker produce more per hour than he used to (without expending any more physical energy). This higher productivity is not possible without the aid of mechanical devices.

Some wondrous developments in automatic machinery already are with us and more are promised. They are mostly designed to pace the job rather than have the operator do the pacing. Being mechanical and flawless, they turn out uniform pieces of work constantly and endlessly to very tight tolerances, an achievement that would not be possible if the human hand had something to do with it.

Impressive evidence of what is now being done in tape control of machine tools is contained in the 24-page Special Report in this issue beginning on page 133.

In most cases, it is not just the direct labor saving that justifies the use of automatic machines. It is the over-all cost of making each piece, compared with the previous cost. Production is higher, the product better, and the cost lower.

How long can this cycle of ever-higher wage rates and ever-increasing mechanization continue? No one really has a pat answer to that question. But one thing is sure: We are just in the pioneer days of mechanized production.

We are not much farther along, in fact, than the horse-and-buggy stage. The vistas that open up for automatic production are tremendous. And that means that productivity—output per manhour—is bound to rise through the years.

There is only one "if" attached to this prediction. Productivity is bound to rise *if* metalworking management is wise enough to make the necessary outlay for mechanized equipment.

Come to think of it, competition most likely will take care of that factor. Competition will put the squeeze on the individual manufacturer to make and sell his product for less, and the only method of achieving that desirable end will be by lowering the cost of making his product. At that point automatized equipment will come into its own.

Burnham Finney

THE MAN WHO SHEARS FOR A LIVING

uses Cincinnati Shears...

1. Quick satisfactory return on investment.
2. Cincinnati Shears produce blanks accurately to a few thousandths without costly dies or special set-ups.
3. They are fast in cutting . . . fast in gauging.
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Investigate these profitable all-steel Cincinnati Shears and their speedy machine tool like accuracy.

Write for Shear Catalog S-6.

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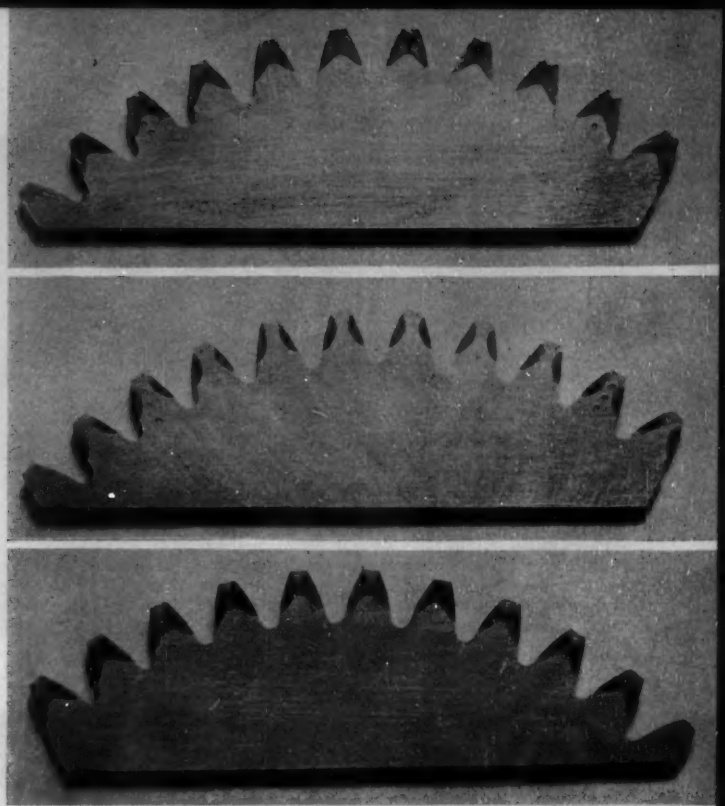
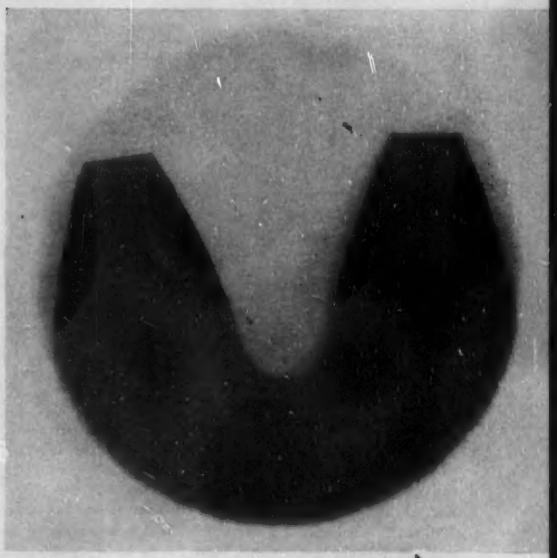


UNIFORM CASE is obtained by induction hardening. Here are cross-sections of a 7.5-pitch gear with 56-58 R_c case hardness, 31-35 R_c core hardness. Opposite faces are shown above and below, with core at center. Heating cycles vary from 3 sec per tooth for 10- and 12-pitch gears to 5 sec for 6-pitch gears. Case depths on 0.50 carbon steel are up to 0.060 in., with hardnesses of 55-60 R_c. A 15-kw, GE, induction-heating unit, operating at 500 to 560 kc, is used. Quench cycles are usually the same as heating cycles, using a 4 to 1 soluble-oil mix

Tooth-by-tooth induction hardening multiplies gear strength and life

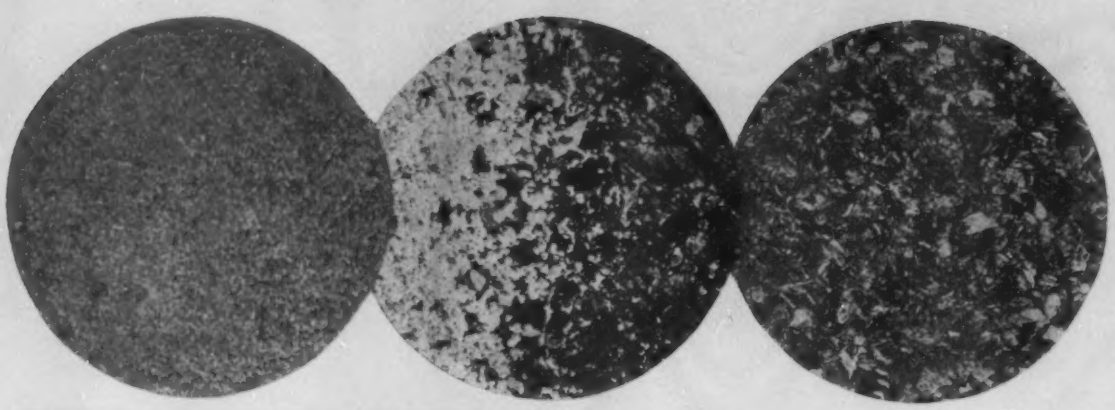
CHARLES A PETHYBRIDGE, development engineer
THE NEW BRITAIN MACHINE COMPANY
New Britain, Conn

Accurate positioning and precise cycle regulation give close control of case depth and hardness without affecting pre-heat-treated cores. Special indexing mechanism, cycling inductor and quench unit, is the key

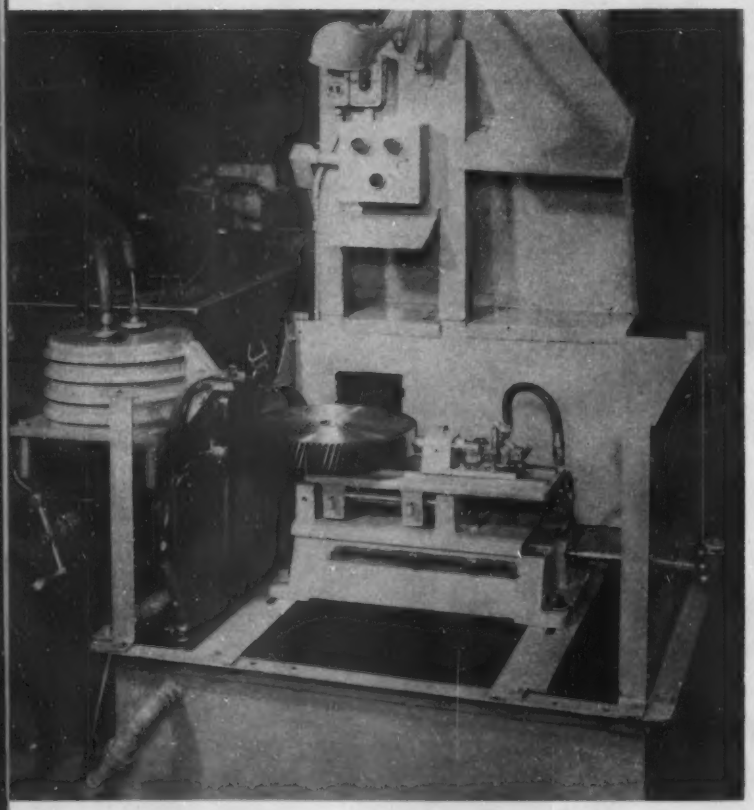


TOOTH CORE is unaffected by the hardening cycle so the blank may be pre-heat-treated to any desired strength before hardening. Here at 5X is a center cross-section of two teeth of a 40-tooth, 1¼-in. face, 7.5-pitch, SAE 4150 gear. Heating cycle was 4 sec per tooth, quenching cycle the same with soluble oil (4-1). Case hardness along the pitch line averaged 56 R_c, core hardness (center of tooth) 31-35 R_c, case depth 0.050 in. The blank was heat-treated to 285-321 Bhn before machining

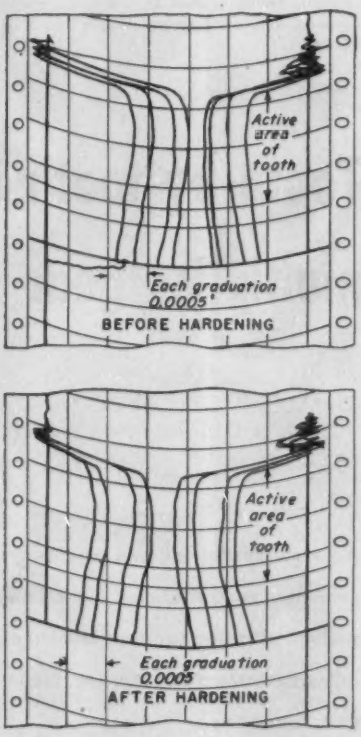
PLEASE TURN PAGE ▶



STRUCTURE of the same gear is shown in these three 200X photomicrographs. At left is the hardened case (56 R_c), in center the transition zone, and at right the core structure (31-35 R_c). This shows clearly the results obtained. Distortion is negligible, usually being 0.0002 to 0.0003 in. swelling on the involute outside the pitch line. This eliminates need for finishing after hardening in most cases. Gears are shaved to size prior to hardening and no further machining is necessary. Gears of extreme precision are finished with special cutters that form the tooth 0.0002 to 0.0003 in. undersize, so hardening growth brings tooth form up to size

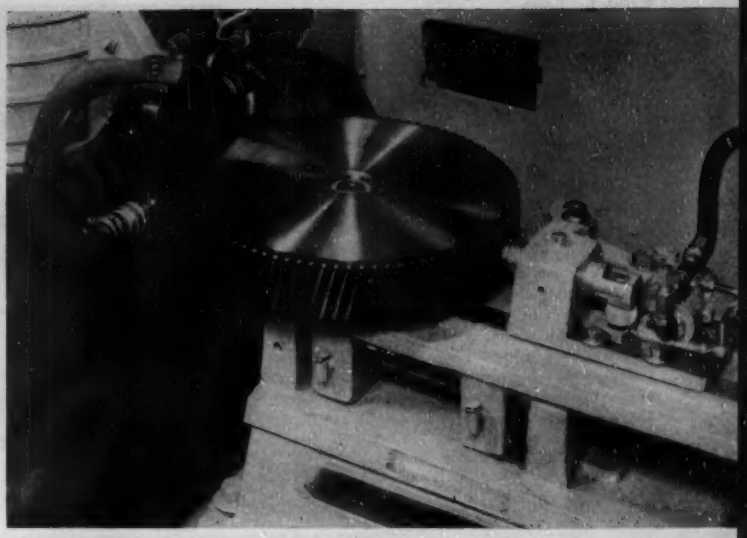


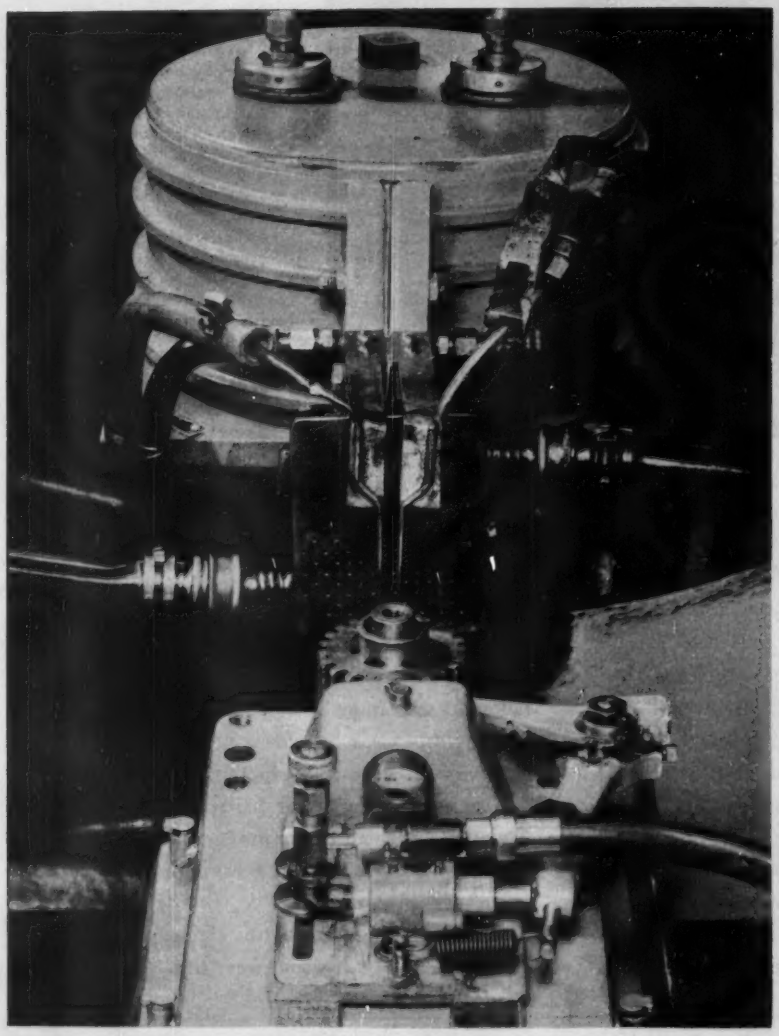
EQUIPMENT is quite simple. It includes an indexing and loading mechanism for rotating the gear and positioning each tooth accurately in the inductor, an inductor shaped to fit the size and angle of gear tooth being hardened, a spray head to quench, a transformer between induction heater and inductor (or coil) to permit high concentration of magnetic flux over the area being heated, and an induction-heating unit of at least 10-kw capacity operating at or above 375 kc. By changing inductors only, it is possible to harden teeth from 12- down through 4-pitch, in diameters from 2½ to 15 in., widths from ⅜ to 4 in., and helix angles up to and including 45°



CHANGE in tooth form brought about by hardening is shown graphically by these charts of a 10/12-pitch gear from a Fellows Involute Checker. Error in form before hardening (top) is about 0.0001 in. (Left-hand curves are for one side of tooth, right-hand for the other.) Change in form is about 0.0003 in. on each side (bottom), so total change in tooth form is 0.0004 in. This is a 20° PA, 14° 55′ helix angle, RH gear

INDEXING mechanism consists of a hydraulically actuated slide on which the gear is mounted on a freely rotating vertical stud. On the same slide is a hydraulically operated lever to actuate a plunger (or locator) and a ratchet arm. The mechanism moves during quench and is controlled by the quenching timer. Cycle: Gear is indexed to position by ratchet arm 180° away from inductor, with slide retracted and quench on. When quench solenoid valve is deenergized, solenoid-actuated 3-way slide valve locates the new tooth in inductor while the plunger engages the gear for positive location and the ratchet arm is withdrawn. The plunger holds the gear indexed during heating. As the heating cycle ends, the relay which energizes the quench solenoid valve also energizes the slide solenoid valve, so the slide retracts. A second hydraulic cylinder withdraws the locater and indexes the gear one tooth, but slide remains in retracted position for duration of quench. A spray-type quenching head, directly behind the inductor, floods the tooth with water, soluble oil, or oil. Quench cycle is dependent on mass being heated, is continued only long enough to lower tooth temperature below 200 F



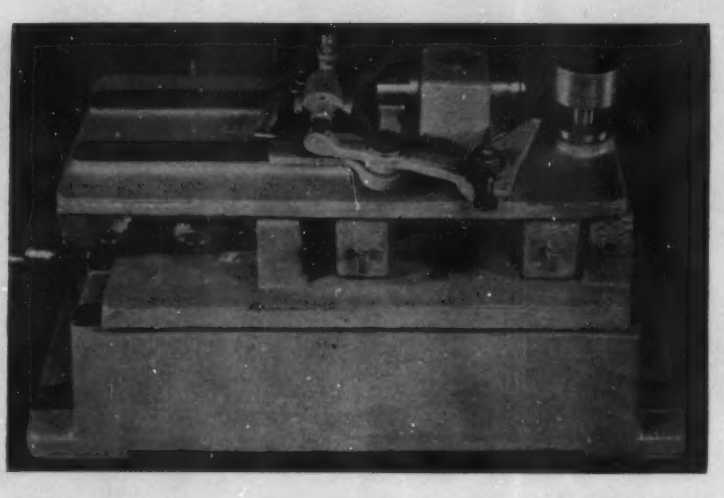


A SINGLE-TURN focus inductor gives a highly concentrated band of heat on the tooth. To provide the high current concentration, power is piped from heater to inductor through a 14 to 1 wax-core transformer. The tooth to be heated is accurately positioned within the inductor, spacing not less than 0.010 in. between tooth face and coil. Inductors are of copper tubing, shaped to follow tooth form and helix angle. Heating cycles are so short adjacent teeth are not tempered. Control from a signal timer (a standard part of the equipment which controls all cycling) is to plus or minus 0.1 sec. Heating times vary with size of tooth thus:

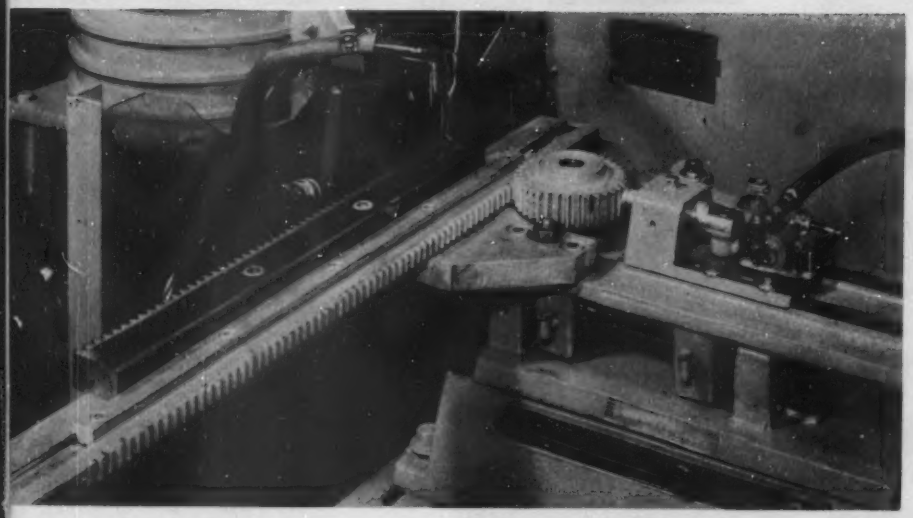
PITCH	HEAT TIME, SEC
10 and 12	3.0
9.5	3.4
8	4.0
7.5	4.0
6	5.0

PLEASE TURN PAGE

Tooth-by-tooth induction hardening . . . continued



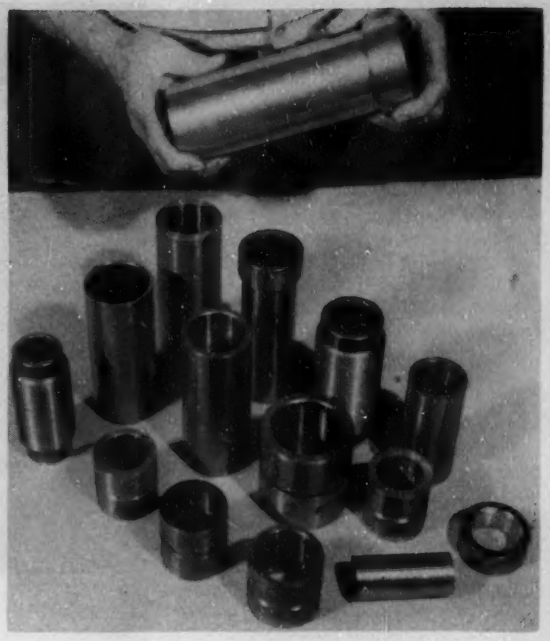
SEQUENCE is automatic until all teeth are hardened. A predetermining counter, set for the number of teeth in the gear, stops the process automatically when the last tooth is hardened, thus precluding damage to teeth by rehardening and permitting the operator to run two or more hardening setups with safety. Following hardening, gears are tempered to 350 F before delivery to stock. Here is shown the back of the fixture, including indexing ratchet and slide-actuating cylinder. The slide moves forward on bar ways. The base slide is hand adjusted for the initial positioning, is thereafter not used



RACKS of any length are easily handled by adding an attachment to the indexing mechanism. This translates rotary motion of a master gear of the same pitch as that of the rack to be hardened to the linear motion of a slide actuated by a master rack in engagement with the master gear. One end of this slide is retracted by the indexing mechanism to clear the inductor for indexing. A rack of any pitch can be processed by inserting a master gear and rack of the same pitch

BENEFITS FROM INDUCTION HARDENING . . .

1. Eliminates need for carburizing and subsequent rehardening.
2. Eliminates need for copper-plating gears requiring machining after carburizing and hardening.
3. Permits finishing of gear prior to hardening of teeth because of slight deformation in process.
4. Permits hardening teeth of gears formerly considered impractical because of size.
5. Permits standardization of materials for gear blanks—no need to stock carburizing grades and heat-treating grades in duplicate.
6. Permits pre-heat-treating gear blanks for maximum tooth strength.
7. Reduces cleaning costs subsequent to hardening.
8. Eliminates need for shipping gears to heat-treat department. Gear hardener can be installed where gears are produced.
9. Eliminates grinding on gears of normal accuracy.
10. Produces gear teeth with greater strength, shock-load capacity and wear life.



BUSHINGS, BEARINGS, AND SLEEVES, machined from continuous-cast bronze bar show better finish and more consistent structure than parts machined from sand-cast blanks, and Brinell hardness is increased 5 points. Greatest improvement is seen in threaded parts. Another benefit is found in lower inventory

Better tool life

Faster machining

Less scrap

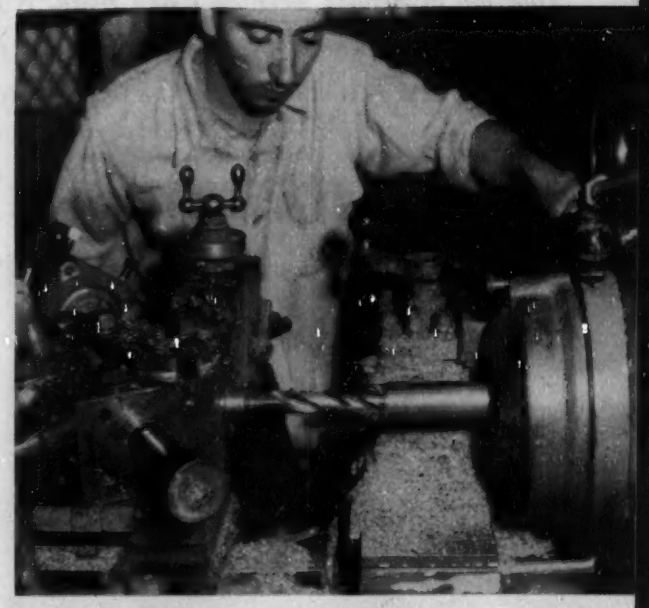
Simpler setup, when...

Continuous-cast bar replaces sand-castings

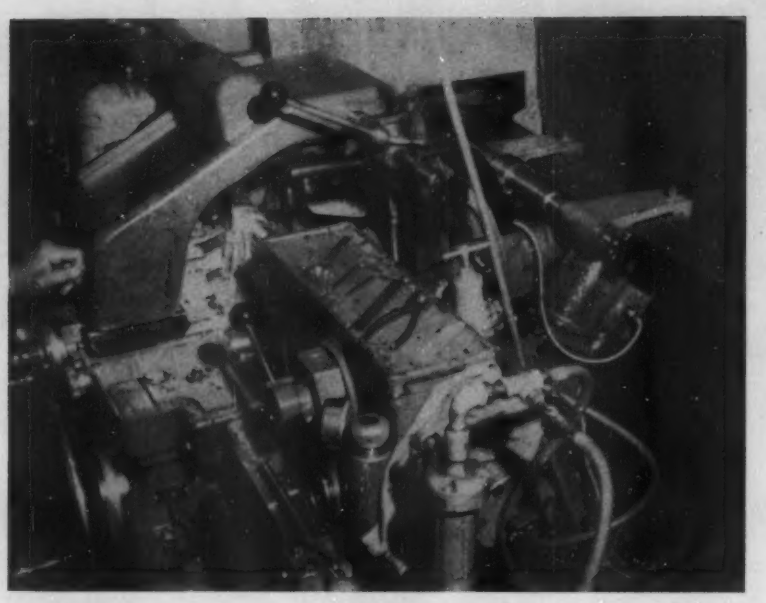
Use of continuous-cast bronze bar stock in place of sand-cast blanks for some of the shaft bushings, bearings, and pump sleeves manufactured by Worthington Corp, Harrison, NJ, provides a number of savings. For example, one part originally made from a sand casting required one hr per pc. Now it is made in 2.7 min., floor-to-floor. Material is supplied by the American Smelting & Refining Co (ASARCO), a product of a relatively new continuous casting technique.

Purchased in bar lengths, the c-c material is machined on an automatic bar machine instead of on a chucking machine. Thus, there is an immediate saving in work-handling time. Also, a greater range of sizes is available from a smaller stock of bar lengths. Estimates show an average saving of 25% when continuous-cast material is used.

Short runs, machined on a turret lathe, are cut at 1000 sfpm, the highest speed available, and no coolant is necessary. Even higher speeds are used on the automatics but these do require coolant. With c-c material, sand inclusions, roughness, and porosity are avoided, hence cutting conditions are better and scrap is practically zero. On one job, machined with a carbide tool, 15,000 pc were produced without any measurable tool wear.



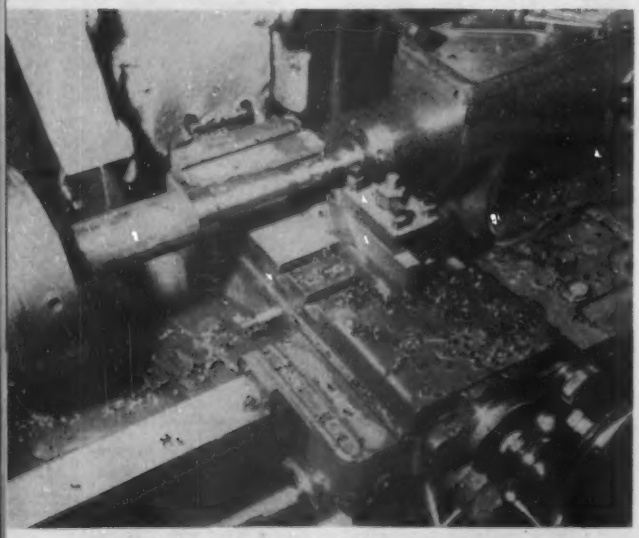
MACHINING AT 1000 SFPM or higher permits this part to be completed in 2.7 min. floor-to-floor. Operations include face, bore, groove, ream, chamfer, thread (in two passes—rough and finish—2½ in.-12 lh thd) and cut-off. Using carbide, tool life is excellent and scrap is negligible. Longitudinal oil groove is cut with a single-point tool mounted at one turret station and hand fed with a "shaper" action



COPYING LATHE, an H E B, is equipped with full-size master on centers behind toolslide. Hydraulic system transfers follower motion to tool at 1:1 ratio

Perpetual motion...

in the methods engineering department is one of the keys to production economies. One job at Bendix Aviation's Red Bank, N J, plant—rough turning and centering a complete generator shaft—has gone through four stages of development so far, and is likely to experience more. On the basis of direct labor costs, here's what happened:



TOOL SETUP is with modified-V-shaped clamped carbide bit (same shape as follower), set straight against work

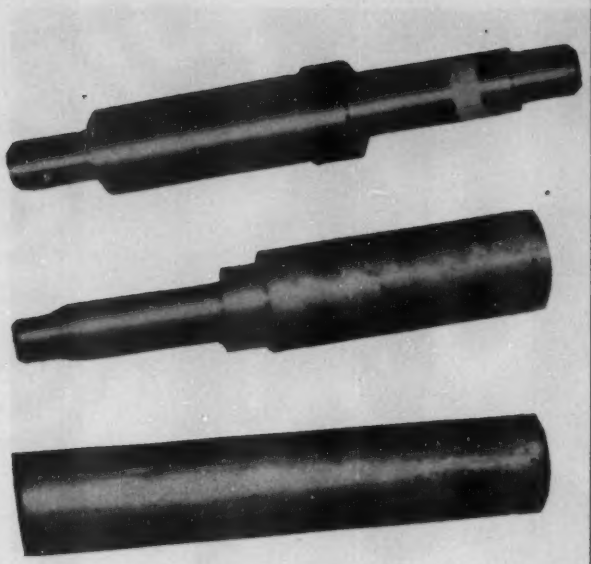
The job started on a turret lathe, where two operations produced the contour, end face, and center in each end of the generature-armature shaft.

1 Rough turn, face, and center one end	0.75758
2 Rough turn, face, and center other end	0.64516
Total direct labor	1.40274

This wasn't too good, considering fairly large orders, so the rough turning was switched to an automatic screw machine, which also handled facing one end, a turret lathe faced the other end, and a centering machine was brought in to do both ends.

1 Rough turn and complete one end	0.33333
2 Face other end to length	0.03333
3 Center both ends	0.01205
Total	0.37871

That's a saving of 73%, and was the most impressive improvement in the whole series. But it turned out that the slugs could be cut to length on the screw machine, the turret lathe could face, the centering machine could be kept on, and the two halves of the



WORK IS STEEL SLUG, contour-turned at one end, then finished in second setup. To switch from one end to the other, master is reversed on centers and work is remounted

contouring job could be handled faster in a copying lathe.

1 Cut slugs to length	0.08000
2 Face ends	0.04200
3 Center one end	0.01205
4 Rough turn one end	0.08333
5 Rough turn other end	0.07407
Total	0.29145

The result now was a saving of more than 79% over the original method. Originally, the screw machine had been something of a bottleneck; but the fast pace of the copying lathe eliminated the trouble, even allowing some other similar contouring work to be handled. Finally, the screw machine was switched completely to other work, and a power hacksaw set up for cutting the slugs to length. The turret lathe now faces off both ends of the slug, and other minor adjustments in cycles have shifted the costs a bit.

1 Cut slugs to length	0.03571
2 Face both ends	0.08696
3 Center both ends	0.01351
4 Rough turn one end	0.07143
5 Rough turn second end	0.07407
Total direct labor	0.28168

At present, all these methods and machine changes have cut the labor charge a total of 80%.

This showing allowed the company to justify the purchase of a second copying lathe, which now works on whip shafts and other work that requires contouring.

Will 100% safety glasses work?

What happens when an industrial shop attempts to get all workers to use safety goggles all the time? Is there heavy resistance, or does the program just rumble to a halt because of neglect? One case in point is Gisholt Machine Co, Madison, Wis, where eye injuries had worried management, who finally decided to institute a 100% eye-protection program.

Gisholt turned the problem over to the accident-prevention division of its insurance carrier—Employers Mutuals of Wausau—who prepared and presented a formal program.

February was set aside as Preparation Month, and March 1 was the target date for the start of compulsory goggle wearing for every employee, regardless of department. Regular group conferences were held to inform all management men.

Gisholt President George H Johnson signed personal letters to all employees, explaining the program and asking for complete cooperation. He said, "In this manner, your God-given gift of sight will be preserved. A glass eye is no substitute for a real one, and a compensation check will not replace a paycheck."

It was decided to provide all goggles, prescription-ground or plain, to employees at company expense, and any employee leaving the company after 18 months could keep the goggles.

Minimum goggle requirements were established for the various kinds of jobs performed in the plant with the aid of an optical company, the insurance carrier, the Wisconsin Industrial Commission, and from the experience of other companies.

SELLING THE PROGRAM

During February the foremen took the burden of gaining acceptance of the program from the employees. Personal talks were aided by facts such as:

- Wisconsin Industrial Commission rated a lost eye at $10,150 in compensation; so the employee should rate it higher.
- There is no provable harm from wearing glasses over a period of time, and safety glasses do not reflect more light than regular spectacles.
- Safety glasses are ground the same as reading glasses; the ones being purchased by Gisholt were the finest money could buy.
- Nobody, regardless of type of work, could consider himself safe from eye injury.

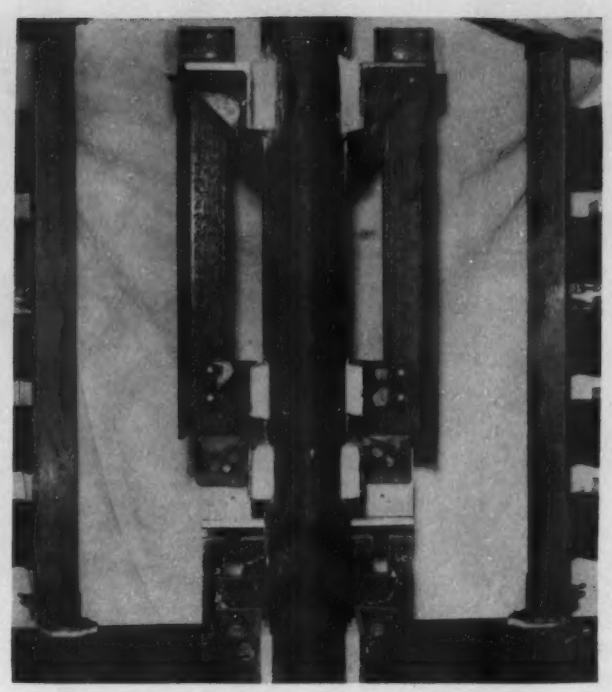
Employees were told that safety goggles are heavier than reading glasses because they are required to be 1 mm thicker, and that the curve approximates the curve of the eyeball and of the lens. Also that curved lenses deflect flying objects better, and are more apt to break away from the eye than toward it.

Top management was the first group to go through examinations and to don goggles.

The program is now in full operation, and has cost about $13,000, or $8.12 per employee, thus far. Regardless of final cost, Gisholt figures to make back the money in reduced accident costs, lower insurance rates, and in the elimination of eye injuries.

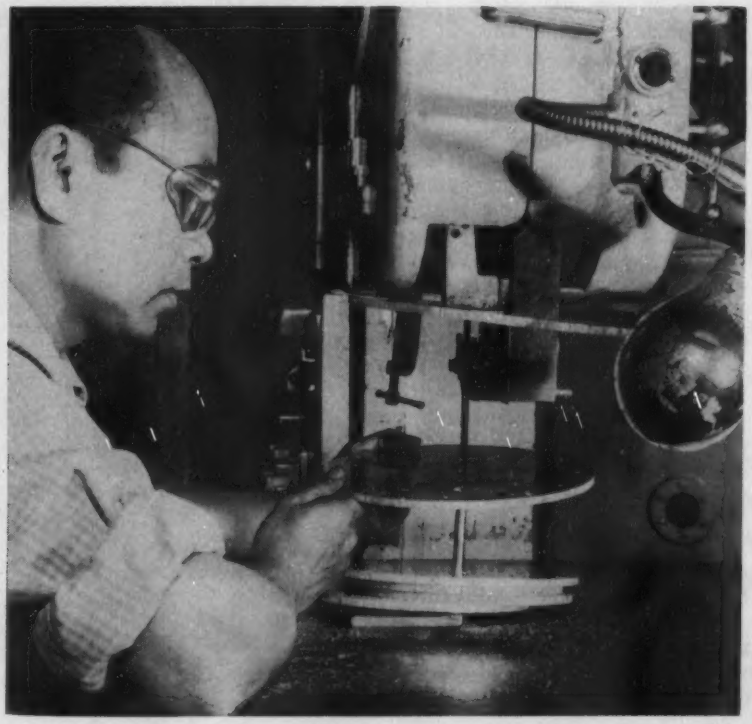
Enamelled CI burner sections . . .

. . . operate up to 800F without rusting, which used to cause part contamination in the furnace. Parts could not be allowed to become contaminated because they were critical defense components. Burner sections were wire-brushed and pickled; then enamel coat was applied, followed by acid-resistant finish coat fired at 1600F. *Erie Enameling Co, Erie, Penna*



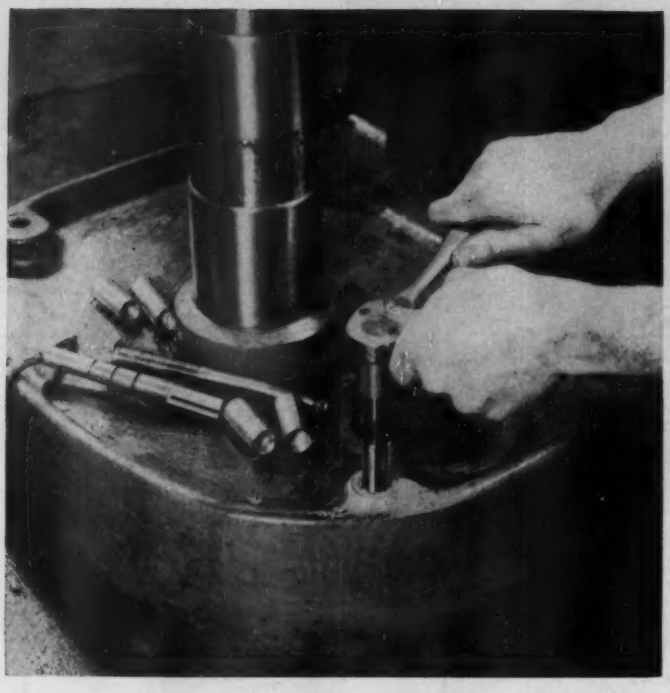
Dental plaster forms locating pads . . .

. . . for some aircraft tools where preset dimensions must be maintained. Material replaces low-melting-point metal; works easier and stands rougher usage. Expansion when drying from the flour-like original material is less than for metal cooling; it stands pressures up to 11,500 psi. *Consolidated Vultee Aircraft Corp, San Diego, Calif*



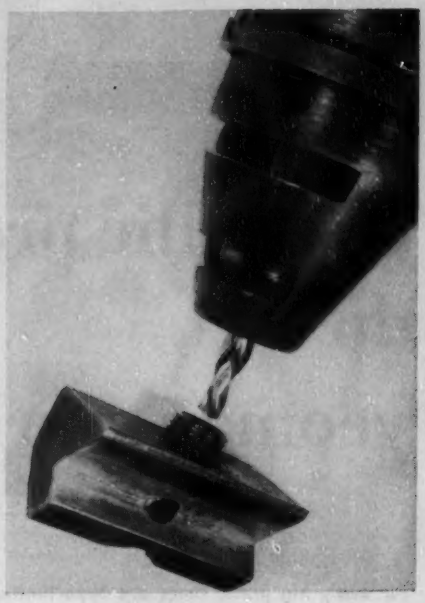
Slotted metal post . . .

. . . (under workpiece) guards bandsaw while one hole is being enlarged and other parts are already strung on saw. Unfinished work rests on table, finished is clamped above to machine frame. Idea allows stringing up to 12 parts on saw blade, then rewelding blade to go ahead with operation. Formerly, blade had to be broken, rewelded for each part handled. *Boeing Airplane Co, Seattle, Wash*



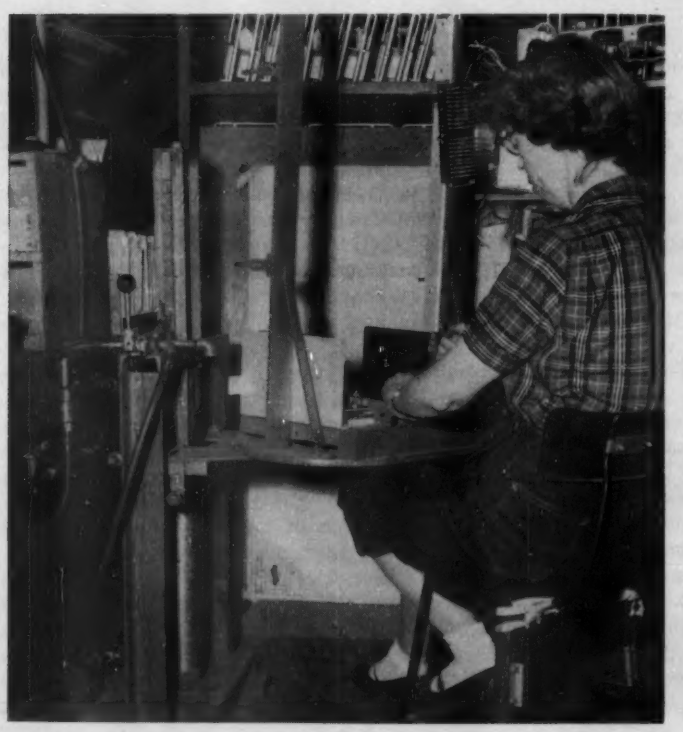
Machine-tool leveling done without shims . . .

. . . if cored base holes can be tapped for Heli-Coil inserts. Hole sizes are usually in proportion to machine weight, so system is normally strong enough. After inserts are placed, bolts with threads ground off end sections are inserted and locked with nuts to level machine. Result is non-corroding mount that can be adjusted if machine location is changed. *Heli-Coil Corp, Danbury, Conn*



Chamfer guide attaches to . . .

. . . Quackenbush air router to assure quick, uniform 45° chamfer to any depth desired. Guide is a steel block, V-notched and drilled to expose the drill end. Different angles can be chamfered by drilling clearance hole at different angle. Guide is moved up and screwed into router spindle for positive location. *Temco Aircraft Corp, Dallas, Texas*

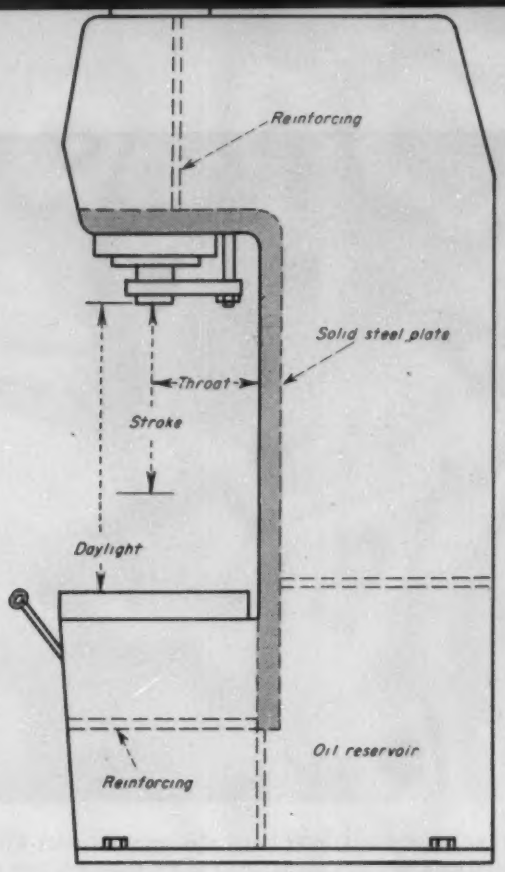


Pneumatic lift levels worktable . . .

. . . to right height when electronic instrument panels are wired. Table is lifted by operating air-valve handle (left), can also be rotated 90° to make work more accessible. Two quick-acting clamps on rig hold chassis base against locating pins; two other clamps release platform so it can be rolled away on dolly when assembly is heavy. Unit includes ratchet safety stops that prevent platform drop. *Lenkurt Electric Co, San Carlos, Calif*

Small hydraulic presses do yeoman work

For every big press, there are opportunities for 15 to 20 small ones. Say jobs from 1 ton up. The small C-frame hydraulic press has moved into this field and is doing all sorts of jobs in modern shops



C-FRAME PRESS CONSTRUCTION. Tension members are not needed because of tonnages used; for operation involving much accuracy, diesets are employed

RALPH H BEHREND, manager, C-Press Division, HYRAULIC PRESS MFG CO

Operations on small parts are now being done to an increasing extent upon hydraulic presses. Not the huge machines that you see in aircraft plants, but small floor or bench-mounted units. These are versatile. They can do about every pressworking operation you can name, and they are as fast as many of their mechanical competitors. But when an overload arises, they stop instead of wrecking themselves.

For small-parts production, the C-frame, open-gap press has broadest appeal. Its working area is open on three sides for ready accessibility. Hoppers, bins, and trays can be placed close to the working area. A dial feed may be applied. The press is not limited to single-action operation.

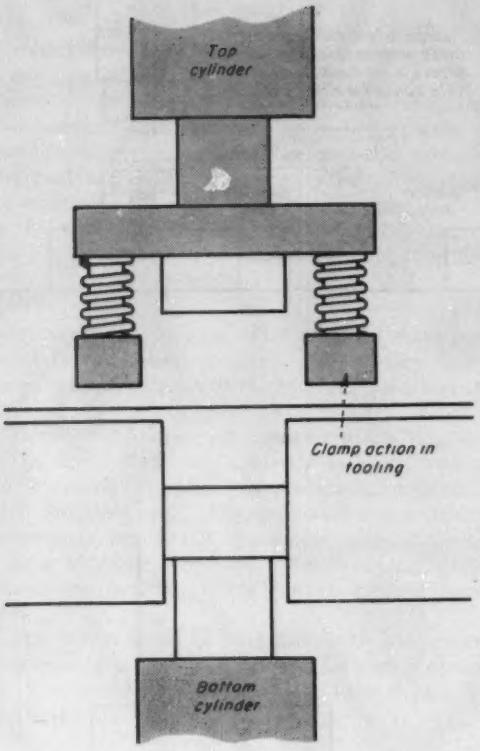
Double and triple actions are achieved on small C-frame hydraulic presses in a manner somewhat different from that used in large machines. Because one ram is used for most applications, other motions are designed into the tooling. The big double-action press provides one ram for clamping the work and one for drawing. In small C-frame presses, clamping is obtained through spring-loaded blank holders or rubber pads because only low holding pressures are involved.

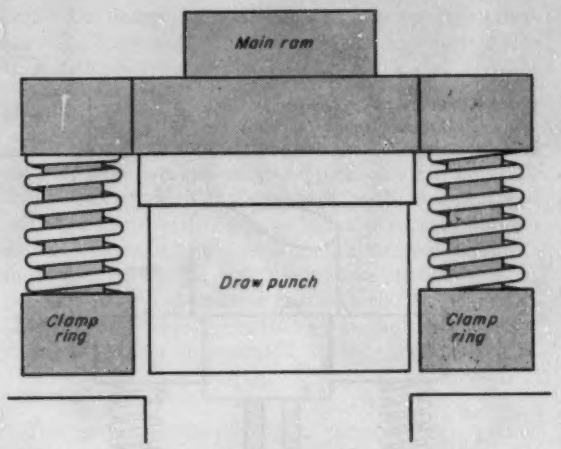
The functions of a triple-action press are duplicated in the low-tonnage presses with a top and bottom ram and a mechanical clamping device in the tooling. However, a small cylinder may be mounted in the U-slot base of the frame to be used as a die cushion. This cylinder may be either pneumatic or hydraulic.

Controls for C-frame presses are of several types: manual, manual with controlled pressing speed, automatic, automatic with hydraulic interlock, automatic with pressing speed control, or automatic with repeat stroke control within each complete cycle. Certain automatic models incorporate all of these features.

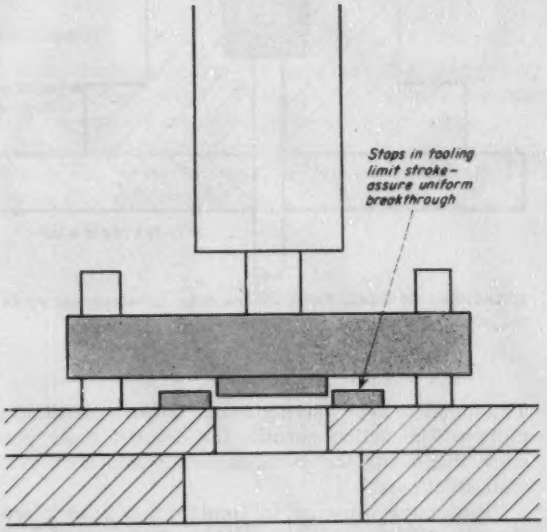
The operation of the press control valving may be accomplished in three standard ways: (1) hydraulically, (2) electrically, or (3) a combination of the two. Electric control is usually faster; hydraulic control provides an accurate means of producing certain motions that can not be duplicated otherwise. A combination of both is an ideal arrangement where more than one motion is involved.

Standard accessories are available for various production requirements, providing the basic elements for special machines at low cost. The hydraulically driven index table, for example, provides a means of feeding parts to a central work station. The table is controlled through a hydraulic interlock





FOR DRAWING on a small hydraulic press, a spring-operated blank holder suffices. To achieve a triple action, a small cylinder in the base acts as a die cushion



BLANKING IS SUITABLY DONE on a small hydraulic press. The press is fast, stops limit the stroke for uniform break through

system, synchronized to operate in sequence with the press ram, and utilizes a single power source. Sometimes larger dials are employed, so that several operators can load parts and remove assemblies.

The applications for the C-frame press are countless. Some of the most commonly known jobs are:

ASSEMBLY

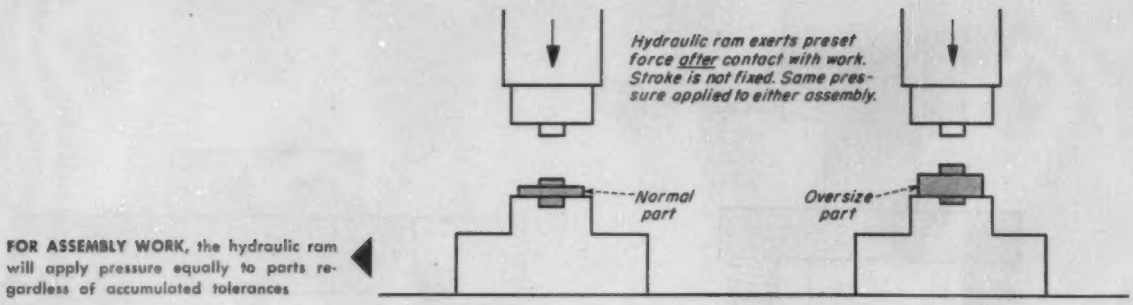
When parts are to be assembled to dimensional specifications, all parts must be uniform in size. But variation in size of small parts does occur. When these are gathered into an assembly, their accumulated dimensional errors can produce a serious condition if the press stroke is fixed. The hydraulic ram automatically compensates for off-dimension assemblies, because only the preset tonnage can be applied. No "over-pressure" condition will arise to damage the dies or press.

Spinning has long been popular for assembling several parts that include a moving element, such as a pulley, lever or wheel. The operator manually applies a force that flares the end of a hollow stud or rivet to retain the parts. Spinning is slow and expensive, however, because it must be done with care.

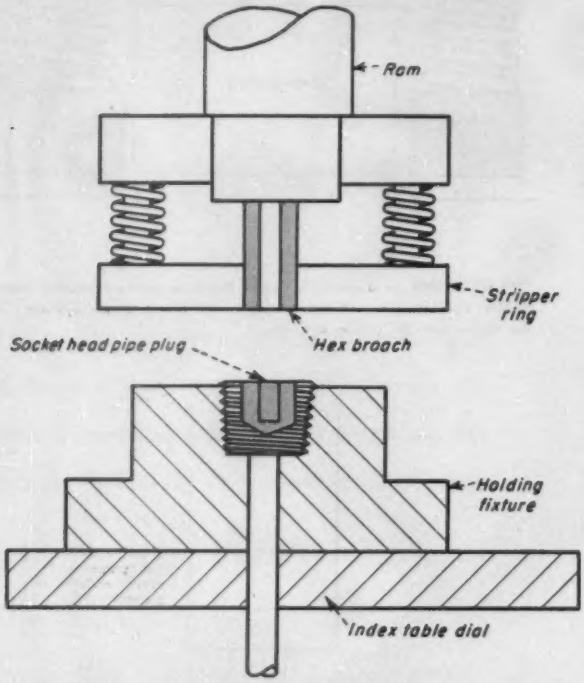
Hydraulic staking and crimping has replaced spinning in many applications. The preset force is always under control, and there is no problem with upsetting to the point that the assembly is distorted or made inoperative.

DRAWING

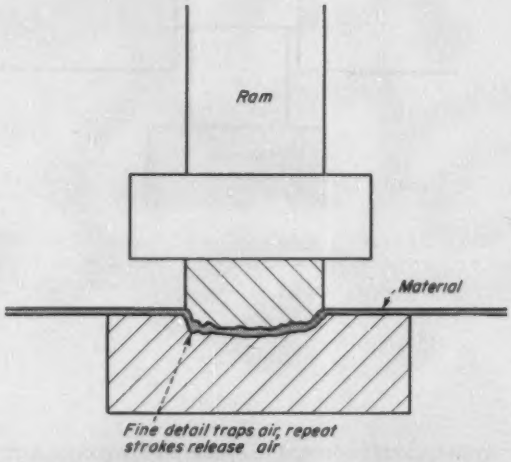
Controlled speed and pressure of the hydraulic ram contribute to successful drawing of metal parts.


Hydraulic ram exerts preset force after contact with work. Stroke is not fixed. Same pressure applied to either assembly.
Normal part
Oversize part

FOR ASSEMBLY WORK, the hydraulic ram will apply pressure equally to parts regardless of accumulated tolerances



BROACHING OF SMALL PARTS can be done, if the required stroke is not too great



COINING ON A HYDRAULIC PRESS, using repeated strokes, "bumps" the metal to the desired contour and releases trapped air

The metal is kept moving in one smooth continuous motion. The action permits the deepest draw possible, displacing the metal smoothly and with even wall thickness.

Progressive drawing in combination with piercing and blanking operations are also accomplished. Because deeper draws are possible, it is often true that fewer stages are necessary for production of deep-drawn parts.

TRIMMING

Gates and flash on die castings are irregular in shape and thickness. If an exceptionally heavy flash is encountered, no damage is done to the dies, the ram stops and the part is not trimmed. Tonnage may be set slightly above that needed to trjm normal parts. This will take care of partial dulling of the dies or a thicker than usual trim. When the dies dull after long operation, the metal will indicate this condition. Thus the work itself acts as an automatic inspector.

A small C-frame trimming press is sometimes transported by crane to various casting areas. This saves the lost motion of hauling cast parts to a trimming station.

BROACHING

The controlled power stroke and uniform speed of the hydraulic ram transforms the C-frame press into a broaching machine for certain jobs. The machine has a long enough stroke for push-through broaching, serrating and other operations. Small surface broaching is possible when guides are installed to hold the broach on work.

Automatic presses on single cycle control provide a positive single-stroke broaching action that will continue through one complete cycle before stopping.

STRAIGHTENING

Straightening operations are commonly done on hydraulic presses. Access from three sides permits the handling of long shafts and other parts. These C-frame presses are usually manually controlled by hand levers. The ram may be inched upward or downward, applying as much or as little pressure to the part as needed. Gages may be set to make quick checks of the work from time to time.

In the case of larger and heavier parts, shuttle tables are incorporated to move the part laterally.

COINING

C-frame presses in sizes of 25 tons and more may be used to coin small emblems and jewelry items. Some of the advantages of the hydraulic method include:

1. Better elimination of trapped air within the dies. In these cases, the material is given two or three "bumping" strokes—short repeat strokes within each complete cycle. Air is released and a cleaner impression of fine detail is possible.

2. Less tonnage is needed. The bumping stroke produces the desired "extra" effort without harsh impact.

3. The material is not hardened to the extent that annealing is required prior to following operations. The metal is given a chance to flow into the contours of the die.

BLANKING

Blanking is most often handled on mechanical presses, but there are advantages to the hydraulic method.

1. Speeds of the C-frame hydraulic press are comparable to some mechanical presses. The stroke of the ram can be easily regulated—just enough to clear the dies.

2. Blanking dies must punch through work at least 0.005 in. In setting up the dies on mechanical equipment, considerable time is consumed in getting just the right "break-through" for longest die wear. On the hydraulic press, the ram reverses after a preset pressure is reached. Therefore, stop blocks can be provided so that break through is controlled automatically for each setup. Die sets assure accurate alignment of dies.

3. Automatic strip and roll feeding devices can be supplied to the hydraulic C-press or strip metal can be manually fed.

4. Pressure of the ram is set just above that needed to break through the material. When dies start to show signs of wear, the material will indicate clearly that dies should be sharpened. Only a few thousandths are necessary to dress the dies when sharpened in time.

Progressive dies for blanking, forming, piercing, etc. can also be handled on the C-frame hydraulic press.

BURNISHING OR SIZING

When dimensional tolerances are critical, bushings and other parts are burnished by pushing a steel ball or a button-type burnishing tool through the part. Such jobs lend themselves to automatic setups, using index table feeding and, at times, automatic loading of the parts. Burnishing operations may be combined with broaching or assembly operations. The downward force, while the part is being burnished, is uniform and the speed is controlled. Such operations are set up and torn down in a few minutes.

MARKING

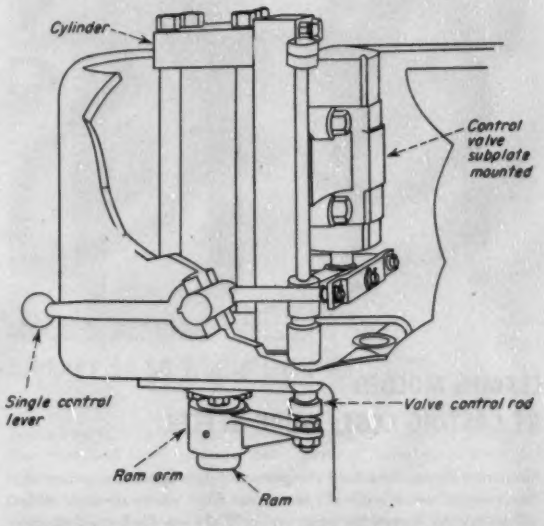
The stamping or marking of parts, assemblies or finished products can be accomplished with the small hydraulic press. Off-dimension parts are marked with the same impression as those of correct dimensions. Castings and other rough formed surfaces may vary in depth, but the hydraulic ram applies the same force each time the material is contacted. If dwell or pressure hold-down is required, the C-frame press can be provided for this type of circuit.

TESTING

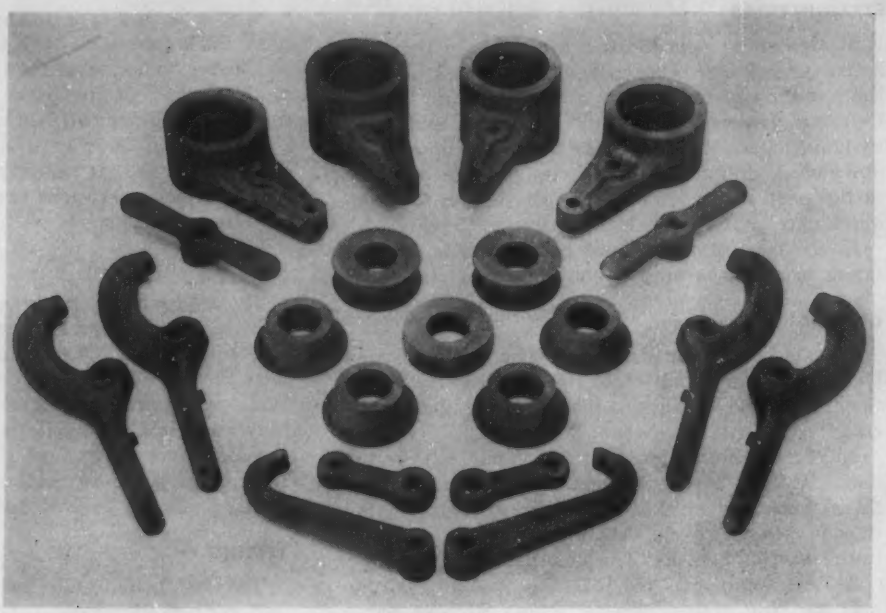
The small hydraulic press provides the power and control variations necessary to make tests on various materials under different conditions. Typical examples include strength and life tests on metals and synthetic materials; torsion tests on axles and shafts; bending, stretching, twisting; fatigue testing of weldments, bonds and adhesives.

DIE TRYOUT

Many companies use the open-gap C-frame press for die tryout work. Pressure and stroke length may be quickly adjusted for proper conditions and the die tested before being assigned to other equipment. The exact tonnage needed for handling the job can be determined.



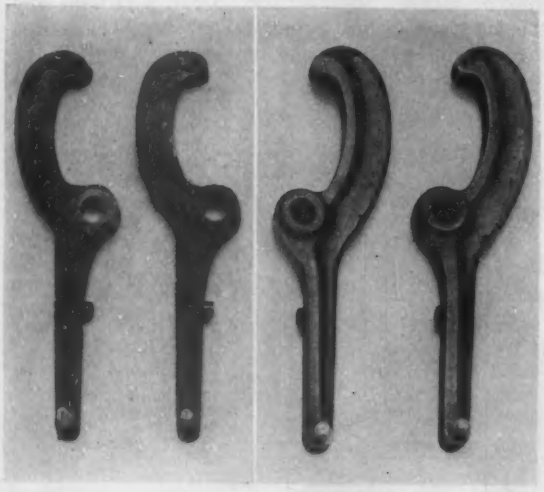
CONTROLS FOR SMALL HYDRAULIC PRESSES can be arranged for manual or automatic operation, depth of stroke, controlled pressing speed and in various combinations of desired features



AVERAGE SAVINGS . . .

. . . on parts being shell molded instead of fabricated or sand-cast and machined is 20% up

Is shell molding practical



CLAMPS MOLDED AT CASTING COST; WORK BETTER

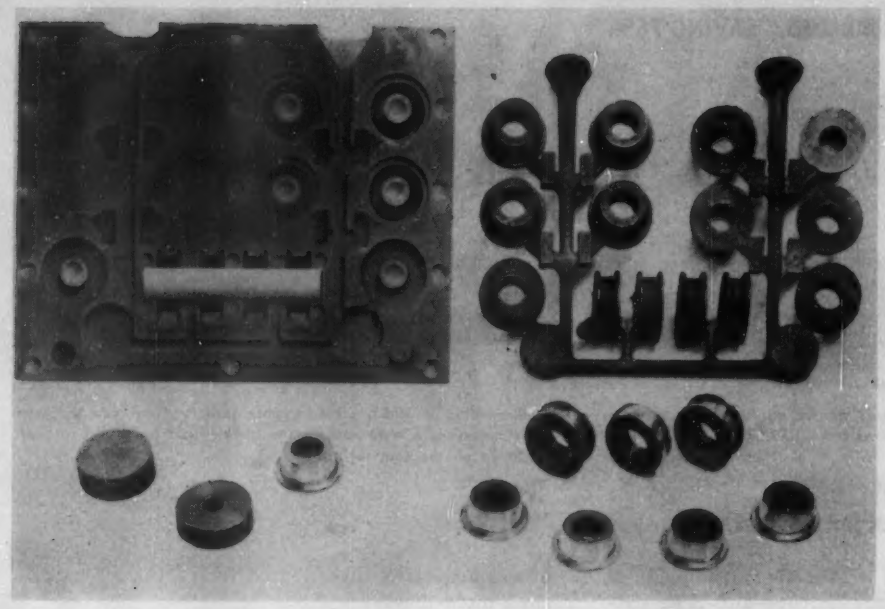
Automatic clamps that hold the pattern frame to the dump box during inversion were originally flame cut from plate, sanded, drilled, and pins were brazed in—at a cost of $1.34 ea. Shell molding eliminates drilling one hole and turning and brazing one pin; costs $0.82, saving 38%. Cost for sand casting would have been about the same, but shell molding looks better and functions better

Case histories of actual manufacturing operations are the best basis for judging any process or practice. To test the economy of shell molding on short runs, 23 components of a shell-molding machine were switched from other methods to shell molding. Results were conclusive, because careful study was made beforehand of alternate methods of producing the parts. Decision: Shell molding *can* be economical on job lots, as proven on the basis of costs, part function, and appearance

This question is one that's been argued often, but much of the discussion has been based on theory. The way to decide the question was to try it out in practice, so Shalco picked several components of its own shell-molding machine as test pieces.

The equipment has a limited market, so production quantities are fairly small. But past experience and analysis indicated that substantial savings could be realized, even on small lots. This actually worked out, with cost analysis of each individual part justifying the change from other methods of manufacture.

Savings resulted from three basic factors. The first was elimination of many machining operations. Close



OVEN AND EJECTOR WHEELS MOLDED TO SAVE 70-77%

Two double-flanged, four single-flanged, and one crowned wheel had been machined from solid bar stock at a cost of $2.38 to $2.66 each. Shell-molded wheels cost only $0.54 to $0.71 each, including finish-boring and recessing retainer-ring groove. Precision shell core shown has 1/16-in. wall thickness; completely eliminates finning operation

for job lots?

FRANK K SHALLENBERGER president
SHALCO ENGRG CORP, PALO ALTO, CALIF

tolerances, smooth finish, and many details such as holes and pins that could be molded into the parts complete, without later machining, made the difference.

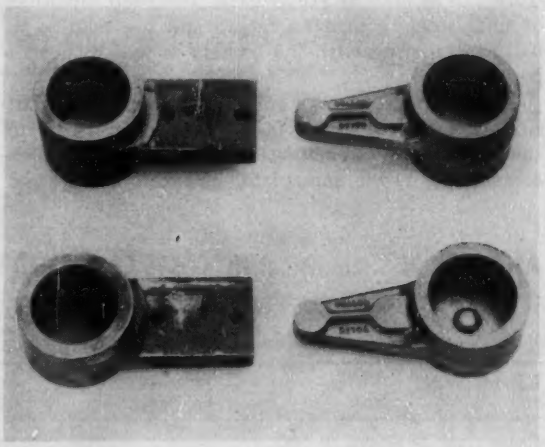
Second, weight of metal consumed was reduced because of close tolerances. Even though early shell-molding claims sometimes led to too much enthusiasm and later disappointment, production tolerances can be held around 0.005 in./in. Obviously, configuration of the part and the metal to be used exert some control on tolerances, so design and metallurigal requirements must be discussed frankly with experienced foundrymen before the design is frozen.

Third, easier machining of shell-moldings cuts machining time, where it is required, and saves on tool wear. There is virtually no "skin" effect on shell moldings, so the usual chilled surface on a casting, through which a tool must cut to get at the metal, is missing. In general, the surfaces are fully machineable, and cuts a few thousandths deep can be made without hitting sand inclusions and blow holes.

Direct savings on the parts molded ranged from 27 to 83%, and have justified conversion to shell molding in themselves. Equally important advantages are less tangible; they include general part quality, appearance, and part operation in the assembled machine.

Test Parts

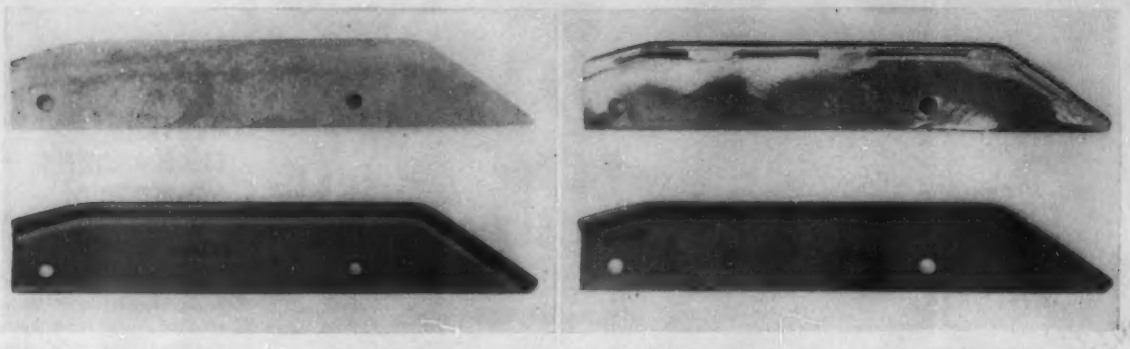
Wheels were the first parts shell molded. The pattern and core equipment for the job cost $500, and



MOLDED BEARING HOUSINGS REPLACE $8.50 WELDMENTS AT $1.43

Dump box for the molding machine rotates on bearings carried by the front and rear housings. Sand castings were considered, but tolerances on the cylinder OD, which fits a socket on the machine's rail end, could not be held; nor could the OD be machined readily because of the arm. Costs for shell moldings are $1.43 and $1.76, savings of 75 and 83%, with only the riser to be belt sanded, ID and ring grooves to be bored, and two holes to be jig-drilled (included in cost figures)

CAM TRACKS USED "AS MOLDED," SAVING 76%



Hot-rolled strip and steel plate was welded up to cam-track shape until the conversion, and the process cost $3.35 per track. Cost with shell molding is $0.82, piece is more uniform, and now includes trade name. As a sand casting, the track would have had to been machined on the cam surface

Is shell molding practical for job lots? . . . continued

it produces 14 wheels on a 14 x 18-in. plate. As in most cases, a simple aluminum cope-and-drag pattern was ideal for the short runs. Cost for the equipment was amortized on the first 19 molds poured. The job could have been done with sand castings, but they would have required machining, running the cost up to $0.70 to $0.85 each, with the pattern and core box costing about $350.

Bearing housings were the next item. Originally they were made of heavy seamless tubing welded to flame-cut arms, costing $8.50. Estimates for outside work ran as high as $10.50 each. The shell moldings of semi-steel require no facing and are held to ± 0.010 in., mating with the sockets in which they fit perfectly.

The automatic clamps and cam tracks worked out similarly. Six other parts have been switched to shell molding, with savings of about 20%, and such components as the nameplate, sprockets, knobs, and others are being investigated to see if they can be shell molded with economy.

Conclusions drawn from this experience are:

- Shell molding can frequently offer economic advantages over other production methods, even for job lots.
- Shell-molding pattern costs are not as high as generally believed.
- Major advantages of the process are closer tolerances, weight reduction, improved surface and appearance quality, and often better functioning of the parts.
- Savings vary widely from piece to piece, and the decision to shell mold or not should be made with discretion and based on the economics of the situation.
- Chemicals and resin-coated sands, shell-molding equipment, and casting techniques have improved since the method was introduced, and performance can be accurately predicted.

ANALYSIS OF SHELL MOLDING COSTS COMPARED WITH PREVIOUS METHODS

PART	PARTS PER MACHINE	ORIGINALLY MADE BY	FINISHED COST ORIGINAL PROCESS	FINISHED COST SHELL MOLDED	SAVING PER PIECE	PERCENT SAVING	PATTERN & TOOLING COST	TOTAL PIECES TO AMORTIZE PATTERN
Ejector Wheels	4	Machined from bar stock	2.38	.54	1.84	77	$500.00	272
Front Oven Wheels	2	" "	2.66	.65	2.01	76		248
Rear Oven Wheels	1	" "	2.38	.71	1.67	70		300
Front Bearing Housing	2	Weldment	8.58	1.76	6.82	80	$385.00	57
Rear Bearing Housing	2	"	8.58	1.43	7.14	83		54
Dump Box Clamps	4	Flame cut	1.34	.82	.52	38	$300.00	580
Oven Cam Track	2	Weldment	3.35	.82	2.53	76	$285.00	111
Miscellaneous Parts	6	Fabricated or sand cast	.28 Average	.22 Average	.06 Average	27 Average	$325.00	5425

American Machinist

SPECIAL REPORT
NUMBER 377

NUMERICAL CONTROL

what it means to Metalworking

WILLIAM M STOCKER, JR and CHARLES D EMERSON,
associate editors

We are on the threshold of an era, perhaps a Second Industrial Revolution, in which manufacturing tools will no longer depend upon man's limited dexterity, in which drudgery will be abolished by automatic controls. With the aid of electronics, coordinated control can be completely remote, sent across a room by wire or around the world by radio. Numerical Control is the first key to this historic problem, to the effective alliance of power and skill. Simple tapes or punched cards will replace tedious setups. Full commands will be telegraphed or telephoned to distant plants, machine to machine, to produce intricate parts without human direction. The age of the true robot is here and experts at MIT believe that it will influence every aspect of Metalworking. Here is a detailed discussion of Numerical Control, where it stands now, and where it will take us.

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Machine-tool control for

"Within three to five years," said a major machine-tool builder's chief engineer, "Numerical Control will cause major changes in current manufacturing methods!"

From where we sit, it looks like the potential changes will be worth watching. Right now a number of projects are well underway toward utilizing the process control that this system affords. Tomorrow's machines will not "outthink" man, but they will outmaneuver him. Unable to scheme to mastery over man, they will be valuable slaves capable of coordinating the thinking of many men to solve complex problems at tremendous speed.

This much you have heard. For some time fantastic computers have been solving problems on paper. But the results had to be manually applied. Now, using Numerical Control, machines will automatically produce complex physical shapes directly from information supplied to an electronic director. Relatively simple conversion devices can control a whole battery of machines—producing around-the-clock without fatigue. Or the same devices can produce three-dimensional shapes which no human could manually coordinate.

What will this mean to you? Generally, more things to enjoy for an even better standard of living at lower cost. Or, perhaps, the four-day week or the six-hour day, with more time for fun and self-improvement. On the other hand, if war comes, NC will be another important production aid. But specific effects will vary.

In most cases, job classifications will be upgraded. Operators will be retrained as observers or as maintenance men. Machinists will be taught setup or programming. Tool Engineers will retain their titles but, in addition to their present duties, they will have to learn a new approach to tooling. Instead of designing massive fixtures or intricate mechanical controls, they will "program," and much of the tooling will be accomplished on mathematical charts. Of course, fixturing and special tooling, plus cutting-tool design and selection, will be required, but the problems will be different. Because the human variables are absent, time study will change its scope. Production time will be a function of machine-tool and work limitations—easily determined and maintained.

All of this mountain won't be moved in five years—but the movement is underway. The techniques are available now, and now is the time to learn the tune.

Imagine, if you will, preparing an operation sheet to manufacture a complicated part. Then, instead of giving that sheet to a group of operators to make

Plus advantages of numerical control...

1..Fully automatic performance of all machining operations which lie within the capability of the basic machine tool.

2..Rapid interchangeability of control equipment from one job to another by simply inserting a new set of previously prepared instructions.

3..Smaller number of work setups and reduced setup time.

4..Accuracy unlimited in preparing control instructions.

5..Multiple machine control by a single system, and control need not be located near the machine tool.

6..Instructions do not deteriorate with use, are readily modified through patching techniques, are conveniently stored, can be shipped (or mailed) anywhere with speed and economy, and may be transmitted between plants by conventional teletype circuits.

7..Of commercial grade, most of the system components are readily available at moderate cost.

8..Inherent mathematical accuracy.

9..Minimum human error in machining procedures.

10..Process preparation remote from machine tool.

11..Part duplication is constant and accurate.

12..Increased machine tool utilization.

13..New business opportunities in previously unprofitable work.

the part, you place the sheet into a controller, or a director, and push a button. The controller sets a machine tool in motion and interprets the information on the operation sheet to completely machine the part without human help. For example, if the machine tool is a lathe, automation equipment might transfer the part to plating, heat-treatment, and grinding; then assemble it with other automatically produced parts—all sequenced and controlled by the "operation sheet."

Ah hah, you say! Maintenance of a system like that must be a tremendous problem. Probably spend half of their time down for repairs. Not quite! After 8000 hr of operation, the experimental prototype milling machine "director" at MIT has had only 3% down-time, and half of this quantity resulted from one unit, which has been redesigned. Most of the control components are standard commercially available parts and tubes, readily replaceable. Also, most of the separate circuits use the same type components, hence the spares problem is not as large as it appears to be. While the prototype equipment does not have plug-in unit assemblies for quick "remove and replace-repair later" maintenance, this feature is recommended for production models.

A series of warning lights shows trouble in each circuit and in each section of the equipment. Malfunction of any control results in warning signals or shuts off the machine.

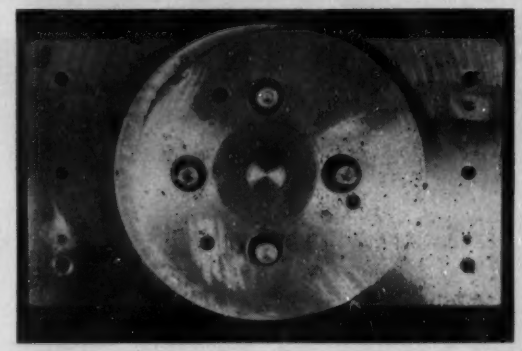
Numerical control, as a philosophy, is the key to truly automatic factories because it provides a "brain" which can be fed information and will interpret that information into physical action. Also important to the push-button plant, this system, through feedback circuits, checks its own progress and introduces corrections. But this is only long-range potential. Let's look at some of the near-future expectations:

Production machine tools for manufacturing complex parts will remove metal continuously and rapidly, eliminating the need for interruptions to check progress with templets or other instruments. Because work can be programmed to take the largest practical cuts (considering cutters, materials, and accuracy), machining time will be considerably less than is customary, and close to optimum. Furthermore, fewer secondary operations will be required, and fixturing may be simpler.

High-speed planer-millers and similar machines providing long cuts will be operated at high table-feed rates in the longitudinal axis while the other axes feed at slower rates. Cams and models are eliminated, thereby reducing setup time and increasing net output.

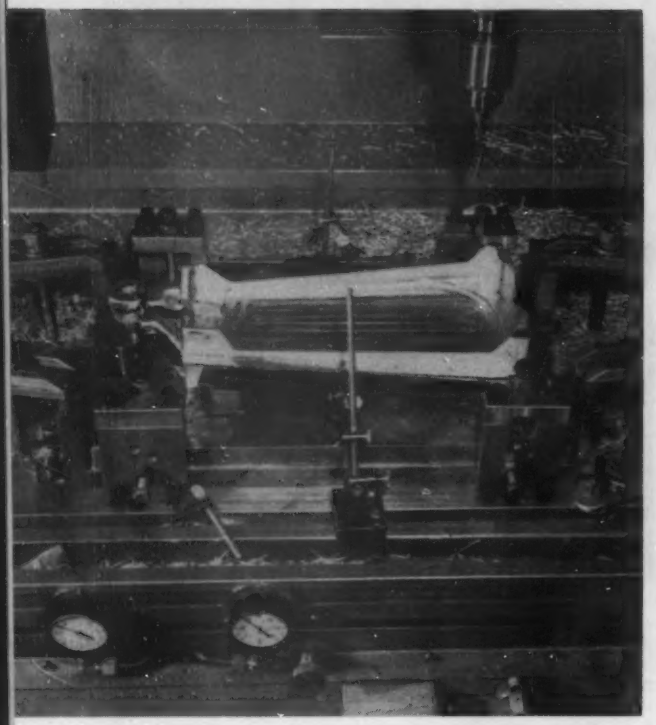
Drilling and boring machines might utilize NC to control table positioning or tool movement for performing a prescribed series of operations. This system could include automatic interruption of cycles to permit tool changes. On a jig-borer, for instance, selector switches are provided to replace hand control. Each switch determines a certain distance

TYPICAL PARTS FROM NUMERICAL CONTROL

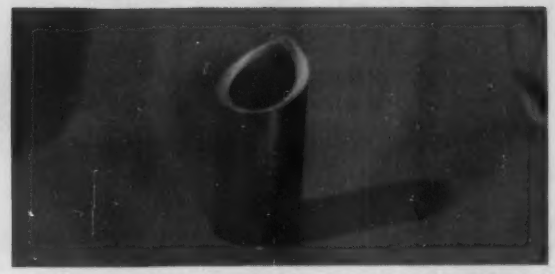


NON-CIRCULAR CAM was programmed in 2 man-hr, with computations and tape prepared in 10 man-hr. An hour of each of the two processes was done on an IBM computer. Setup was made in 30 min; machining of 3 pc was finished in 3 hr. The cam shape was a mathematically defined curve, which allowed working with the IBM computer to save much time. The cam was also symmetrical about a centerline, so the tape had to be only half as long, which saved time, too. Cam was produced in hardened steel

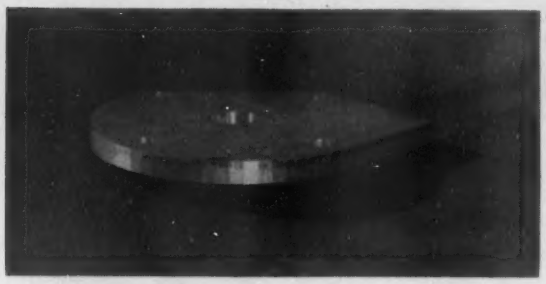
TYPICAL AIRCRAFT FORGING of complex shape and contour was machined in two setups, one for each side of the work. Cutter shown did all machining, which consisted mainly of separated flats and fillets. Tape is relatively short, but includes tool jumps from one to the others of the three machined areas visible, all in addition to control information for the actual machining



ELEVATOR HINGE is another forged aircraft part; was machined in three setups because center web of part was thin and flexible, calling for light finishing cut. Programming took 110 man-hr, computations and tape preparation took 60 man-hr. Machining time was 2½ hrs. Dial indicator helped level part in fixture. Wiggler in spindle chuck locates reference point on work or fixture under spindle; then controls are zeroed-in to start machine motions from that point each time



3-D CAM has a modified sine-wave shape that was mathematically defined, so computations could be partly done in an automatic computer to save time and effort. Programming took 24 man-hr and computations and tape preparation required 36 man-hr. Setup took 30 min, and machining only 10 min. This cam was cut from steel tubing for use on a tracer-controlled milling machine



NON-CIRCULAR CURVE is cut by directing the machine in straight lines terminated within the allowed tolerances of the part. Each straight line is a curve segment; the tighter the curve, the more straight-line segments necessary. To conform to product tolerances, each line must start and stop within the allowable limits of the curve. To test repeat accuracy, piece was blued after cutting and tool was recycled. Note that blue is evenly removed from edge

of cutter travel or table movement. The operator needs no manual skill. He simply sets a combination of switches calling for table movements equivalent to blueprint dimensions, or a "program," then presses a starting button. Automatically, the machine performs the desired operation and stops. For quantity duplication, manual control would be replaced by tape, etc.

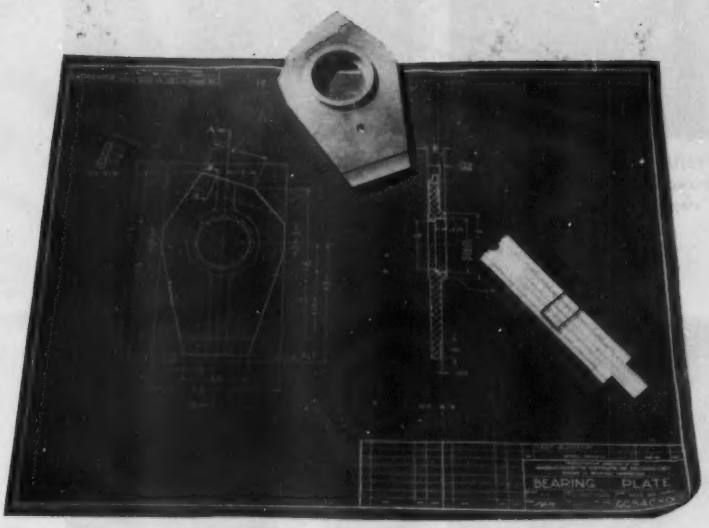
Gaging devices or entire inspection systems can be set up with NC in reverse. A stylus, or light beam, will traverse or scan the completed work and translate the movements into printed tabulations of actual dimensions or note deviations from specified dimensions. It then could reject undersize parts and return oversize pieces to the proper machine for resizing. The printed record could guide selective assembly of the out-of-tolerance parts.

Centralized control of several machines wherein a single unit directs a number of machine-tools or inspection devices simultaneously or in sequence is made possible by an NC director or by a magnetic tape controller, with tape produced by a director. It is expected that accessory tables, with NC, will be available for standard machine tools.

NC-operated drafting machines, capable of producing exact drawings at high speed are readily possible. (Perhaps the machine would best utilize a rotating cylindrical "drawing board" and have the appearance of a lathe.) Design and mathematical information, previously programmed, would be fed into the director which would convert it to inked lines, for comparators, etc. Machines could operate at locations remote from the originating source.

For short, non-repetitive operations, machine tools might be equipped with a keyboard and tape-punch for the operator, who would be supplied with a chart. He, or she, then could set up a machining program on tape, and do other work while the machine performs the operations without attention. However, tape preparations, normally, would be a function of the engineering or tooling department. In the latter plan, the machine operator performs only those simple operations which can be directly controlled by manual switch selection.

Screw-machine control can be improved in a number of ways by using NC—especially where short runs are a problem. The means is a "library" of control media-tape, cards, or film, containing elementary motions or frequently-repeated routines. Combinations of these tapes will control the production of complex parts and setup is minimized. Many or all of the cams can be eliminated. At present, cam control



SIMPLE CAM SHAPE is one machined by numerical control in one setup that could also be done conventionally; perhaps cheaper that way. Part of preparation for NC would be plotting tool center around part outline, using blueprint, extending all surfaces outward by the amount of the radius of the cutter to be used. Easy calculations and quick tape preparation make this job feasible for NC if the cam must be cut completely in one setup because no two cuts are parallel or perpendicular

Proved practical...

by extensive study and use, Numerical Control is not a hypothetical dream. Originally sponsored as the *Digitron* by Parsons Corp, Traverse City, Michigan, under a contract with the Air Materiel Command, USAF, the current program is being carried out at the Massachusetts Institute of Technology. Phase I, a basic study of the principles of numerical control, and Phase II, construction of the experimental milling machine, were done at MIT, beginning in 1949, under the sponsorship of Parsons Corp and the US Air Force.

Phase III, an analysis of machine operation plus an economic evaluation of numerical control, was sponsored solely by the U S Air Force. This phase was carried out at MIT, began in February 1952 and continuous study is underway. Actual application studies have been in progress since the fall of 1951.

Technical details described in this report result from interviews, by the authors, with the MIT men now responsible for the program:

Prof J F REINTJES, Director, Servomechanisms Lab
JAMES O McDONOUGH, Project Engineer
RICHARD W LAWRIE, Liaison Engineer
A K SUSSKIND, Research Engineer
H P GROSSIMON, Research Engineer

permits faster operation than NC for long runs, but NC reduces setup time hence is valuable for short runs. Also, the latter eliminates the need for large inventories of spare pieces, kept to fill customers' small follow-up orders, rather than set up to produce a few pieces in a hurry. With NC, plant production is more closely geared to sales.

Remote manufacture of interchangeable parts is possible with a much higher degree of accuracy. Sub-contractors, widely scattered, could all work from tapes which are exact duplicates. Hence, the parts will be exact duplicates. Part changes or modifications originate with the prime contractor and are delivered (perhaps in the form of directly teletyped tape) ready to place in the director. In this way, all subcontractors interpret each change correctly. Then identical tape controlled "inspectors" further assure uniform results. Very little training is required to start manufacture of a new part. And production time is identical for all sources. Only the quality of facilities is variable.

Not limited to large plants, a complete system for NC uses a general-purpose computer, a director, and a staff consisting of methods men, programmers, and technicians. Unless a company is of a size sufficiently large to utilize this equipment full time, its cost might be prohibitively expensive. However, the unit necessary to actually control a given machine, by interpreting a magnetic tape, is less flexible and much less expensive. Its cost is, at most, about that of the machine-tool that it controls. Thus any shop can afford NC—if a tape producing source is available. The answer is obvious.

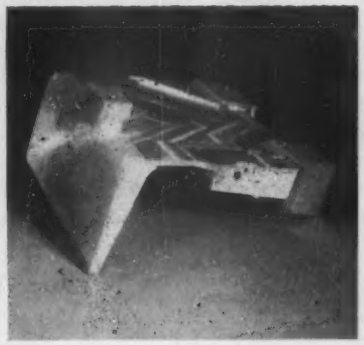
Large companies will own, or lease, and operate their own equipment, supplying "programs" for use in controllers at specific locations in their various plants. Smaller companies will rent programming and computer time, either from the large manufacturers or *from companies which are, or will be established to provide complete programming service.* In the latter case, the small shop management would send drawings and specifications to the programming firm. In return they would receive a magnetic tape ready to place in the machine controller plus the necessary setup instructions. Tapes could be produced right at the controller from impulses transmitted by telephone. Punched tapes can be used in a director just as they are received from a teletype machine.

Numerical control, also, is one answer to the problem of machining complex shapes in radioactive materials by remote control.

1 **FORGED ALUMINUM-ALLOY BLOCK** was start of engine-mount fitting, machined experimentally by numerically controlled milling machine

2 **FIRST SETUP,** after four base holes were drilled for locating purposes, was to hog out stepped cuts to create general shape

3 **SIDE CUTS** removed large sections of scrap, establishing waist in fitting



7 **BASE WAS MILLED FLAT,** leaving front projection and locating corners

8 **CORNERS WERE REMOVED** and projection machined finer to approximate size desired

9 **SHAPING CUTS** were mostly straight-line motions, but many of them radiated from a focus point and few were parallel to a machine way

Automatic control slashes short-run

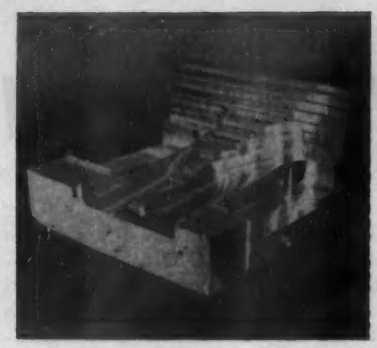
These parts should have been forged from blanks, then lightly machined to dimension on the critical surfaces; but the small order—33 pc—made forging dies extremely expensive. Forging dies *have* been fabricated for orders this small, but in this case the aircraft company that wanted the parts decided to try the MIT machine to see if it could save money. It could and did!

Conventional machining, obviously, would have been very expensive, what with machine time, set-up time, skilled-operator costs, templet costs, fixtures, and all the imaginable complications.

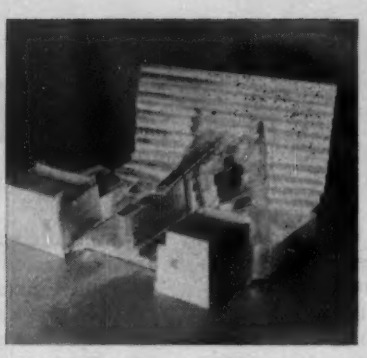
As it was, the Servomechanisms Laboratory at MIT took the opportunity to try out complete machining with numerical control. Some savings could have been made by bandsawing out sectors of the original rectangular forged (for grain structure) blocks. And perhaps some of the machining could have been done more simply by aligning the work parallel to the machine ways for several cuts. But by doing the whole job with tape control, the process used only 10 setups with 10 simple fixtures.

Programming, done by MIT engineers and technicians, took 278 man-hr; computations and tape preparation used 230 man-hr; but total setup time was only 12 hr. Thus total preparation time per pc was 15¾ man-hr, while total machining time per pc was 5½ hr. In addition, some design changes were made during the run, so new programs were easily introduced into the original tape (included in time figures above).

The result was finished parts that required only a little finishing in much less time than would have been required for conventional machining.



4 **CLOSER STEPS** approximated curves of final shape. Remaining corners acted as clamping and locating surfaces for later setups

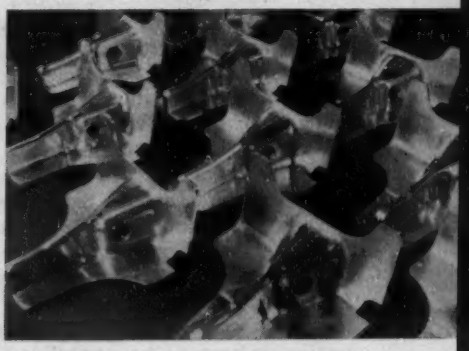


5 **DEEPER CUTS** with smaller cutter continued shaping block

6 **BALL MILL SHAPED CURVES** over crown and on sides with much closer spacing

10 **FINAL RIGHT-SIDE-UP** setup produced fine finish that was later smoothed by hand for appearance and to minimize stress concentartions

11 **BOTTOM REQUIRED LESS HAND WORK** for finishing

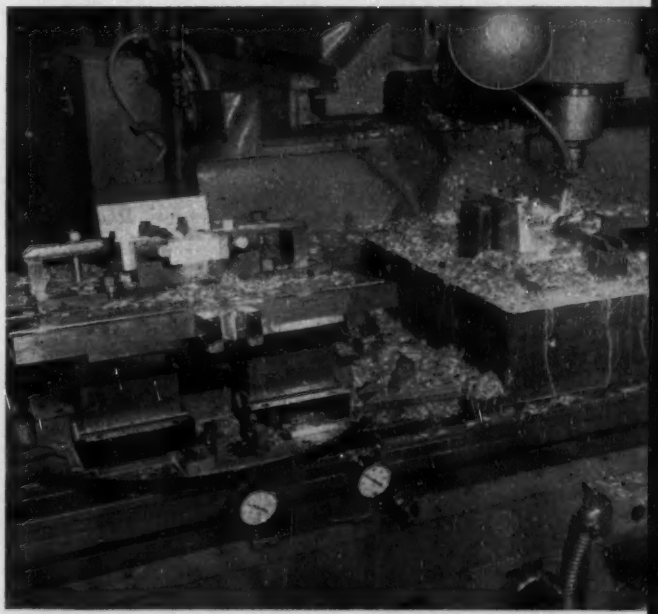


12 **ON EACH SUCCESSIVE PART, DIMENSIONS WERE IDENTICAL** within tolerances possible on the machine tool

forging cost

MIT and the aircraft company now have on file a complete programming breakdown and control tape that can duplicate one of these parts at any time or be used to cut forging dies. All this would take is a little time for fixture setup, plus 5½ hr machining time per pc. The same tapes can also be used for producing forging dies for these parts.

In addition, slightly redesigned parts can be made by adding time for computation and tape revision.



13 **MIXED SETUPS** during fabrication did two or more operations in succession on the same table. Necessary tapes were the regular control tapes for each operation, plus feeder tapes to move the cutter from the end point at one setup to the start point at the other. Only one relationship need exist between the two setups—the cutter should be the same. Mixed setups cut machine downtime, allow catching up on any operation if it has slipped behind schedule

Why numerical

Numerical control is a giant step beyond conventional automatic control. Heretofore, complete machining operations have been automatically executed under control of built-in devices such as cams, templets, masters, limit stops, and metered hydraulic systems. However, the manufacture and setup for tooling of these controls often are elaborate, time consuming, and costly. Much hand-finishing is required. These costs are readily absorbed when large quantities of the same part are to be made, but cannot be justified in short-run production.

For some applications, it has been possible to achieve reasonably simple setup and control equipment, but only by reducing the variety of operations which can be performed on a given machine. Here again, short-run industries are at a disadvantage for they have little use for special-purpose machinery. Even plants equipped for high production are frequently called upon to make runs of spares and replacements and the cost is tremendous.

Thus, short-run production, particularly in the aircraft industry, needs automatic machinery whose flexibility is not limited by control equipment and for which entire setups may be prearranged in a form that can be slipped into the machine tool in negligible time, with preparation away from the machine if possible. NC satisfies all of these needs and provides a few bonus advantages. It is entirely practical to set up two distinctly different parts on the same machine and work them with alternate cuts.

First, machine-tool characteristics

Broadly defined, machine-tools are manufacturing machines which produce finished work by removing material as chips or scrap from a workpiece through *relative motion* between some form of cutting tool and the workpiece. This relative cutting motion is always power-driven, though it may be the only power-driven element of the machine. Because the cutting motion is power driven, it is clearly under what might be called simple automatic control. Regardless of the difference in design and application between specific machine tools, a good least common denominator from the control standpoint is the number of controlled motions.

Thus, some seemingly complex machines actually have only one controlled motion. For example, on a turret lathe, automatic lathe, or screw machine, most of the tooling consists of a single tool or gang of tools which are fed against the work in one direction until a stop is reached, whereupon the tool retracts. An entire job is performed by carrying out a whole series of such operations. Sometimes two or more operations occur simultaneously, but in each case, while cutting, each group of tools in a single setup is controlled in one motion alone. Single-motion control is also represented by a gang-drill station in a transfer machine. Here, hole depth is the only process variable subject to control, disregarding the known drill diameter.

Two controlled motions are provided on other machines to develop the shape of the piece. Conventional manually-controlled or tracer-controlled lathes are examples of two-motion control. When a single-point cutting tool is used on a lathe, the work shape is controlled by radial and axial movements of the tool. Conventional planers and shapers also provide two-motion control.

In recent years, machines having three or more controlled motions have become increasingly important. Common tools in this category are milling machines and jigborers. Another class of multi-motion control arises in multi-cutter machines, such as spar millers, in which several cutting heads are simultaneously controlled in coordination with the major controlled motion. One special class of three-motion cutting is that in which the cutting motion contributes to the work shape. Examples are non-circular lathes and tracer-controlled planers. Here, while the cutting motion is not controlled in the same sense, it nevertheless must be coordinated with the controlled motions.

Coordination is the limiting factor. Any part shape can be produced, or reproduced, on any of the multi-motion control machines, provided that the controls can be applied in sequence—as individual motions. In conventional practice, all machine tools are confined to straight lines and circles. (And product designers are somewhat confined by this condition). Tool or work motions must be either parallel or perpendicular to the feed ways. Any other direction of movement requires an additional control device such as a taper attachment, a cam, an indexing head, or by coupled gearing. However, even with these devices, variations usually are confined to some constant rate.

When, for mathematical curves and other irregular shapes, two or more variable motions must be coordinated, the problem becomes increasingly difficult with the increase in specified accuracy and, sometimes, impossible. Shapes can only be approximated by rough machining and hand finishing. This practice is time-consuming and costly; is difficult of duplication and is seldom absolutely accurate.

Machine-tool control vs human limitations

Machine-tool motions may be controlled in a variety of ways. Old-fashioned brute force by the

control?

human operator provides the simplest method. This technique is adequate, though not necessarily ideal, for many kinds of work on wood lathes, bandsaws, routers, drillpresses, and similar tools. When this direct method becomes unsatisfactory, step two is to provide the operator with some mechanical advantage, usually a set of feedscrews. But control requires force as well as direction. Operators tire.

Add muscle

Horsepower is the next easiest thing to provide automatically. Power feed is achieved by simply gearing the main power source to the feedscrews. Now the operator need supply only intelligence—which feed to use and when it should start and stop. (The same effect is achieved by installing a separate power feed.) At this stage, the inclusion of more than a one-control system is seldom practical because the operator will have difficulty coordinating two or more simultaneous power feeds. Even coordinating two manual feeds is difficult. Thus, when a cut appears to require combined feeds, one of two techniques is commonly used:

1. The two power feeds are geared together. (They also may be electrically or hydraulically synchronized.) This is done in the spiral-milling attachment for a milling machine, in the taper attachment for a lathe, and in the common thread-cutting leadscrew. Each design provides a form of proportional control called *linear interpolation.* For non-linear (irregular) control in this category, cams, rapid-return linkages, and non-circular gears are used.

2. The coordinate system of the machine tool is altered, so that the desired cut can be performed by a single controlled motion. In other words, by changing the parallel-perpendicular relationship of tool and work. Offsetting the tailstock of a lathe to cut tapers changes the lathe from a cylindrical-coordinate machine to a conic-coordinate machine. Swiveling the table on a miller; using a rotary table; or swiveling the compound slide of a lathe, and using the slide feed, produces the same effect. Tilting the table of a bandsaw or drillpress similarly provides a change in the coordinate system so that cuts at any angle to vertical are more readily attained. These two techniques are used again and again, even when fully automatic control is provided, both to reduce the complexity of the control system and to increase its efficiency. However, both methods are limited, either by dependence upon human skill, cost of design and setup, or by a restricted range of coordinated control. This is especially true when non-liner shapes must be produced.

In automatizing the basic machine tool, the next step is to provide adjustable stops which will cause the power feed to start and stop at the right places. A variety of limit switches and throw-out dogs are used to relieve the operator of some of these repetitive tasks. Thus, in addition to feed, size control is automatic. Still, the operator or setup man must position the stops.

After size control, some form of sequencing control is provided hence the machine can be set up to perform a whole series of operations in sequence. However, these are usually one-motion, or at most two-motion, operations. For this change, many stops are provided on each motion, hence the entire operation can become very complex. The final stage of this development is the transfer machine. Various automatic screw machines, lathes, vertical boring mills, grinders, and many other systems employ a similar approach without sacrificing flexibility to the extent represented by the transfer machines. These systems provide the basis for automation in the small shop or for small-quantity orders.

For some classes of work, however, variables are so numerous that the number of stops required far exceeds the number which a reasonably automatic sequencing control can handle. Hence, a closely-spaced grid of points is provided by installing an indexing head on each feedscrew, but then the human operator again must control the sequence of operations, the path which the tool will follow through the grid. At this point in the development of control, a numerical control system is applied.

One final step

However, limit-stop control can be carried one step further before numerical control methods are essential. It is possible to provide a continuous series of stops in the form of a model or templet of the desired work. Thus, the control also becomes simpler. By adding servomechanisms to follow the model, the machine is given the ability to follow not only the position indicated on the model, but also much of the ability to follow them in proper sequence. The human operator now roughly controls one or two motions and all other related motions follow the model. Nevertheless, human skill is still a factor—both in model making and in control. Also, optimum, or even high, metal removal rates are difficult to maintain.

Numerical control makes it possible to provide a system of control for very simple, basic machine-tools in which one-, two- or any number of multiple-motions is readily coordinated, sequenced, or otherwise manipulated.

What is numerical control?

Numerical control makes possible the conversion of dimensions, directions, speeds, feeds, and other design or operating factors directly into constructive functions. Although a new philosophy of control, actually the concept is fairly simple. Each of the factors in any given process are given a numerical value, positive or negative, and all of the values are relative to a constant. Thus, the numerical values can be given physical "body" by electronic, mechanical, sound, light, and similar devices to produce coordinated control of an activity.

Numerical control is *not* a strictly metalworking technique. It is a *philosophy of control* that is applicable to many processes such as textile manufacture, paper making, chemical processing, and the manufacture of electronic equipment. However, Metalworking will be one of the major beneficiaries of this system. Also, it is an important step forward in achieving truly automatic manufacturing.

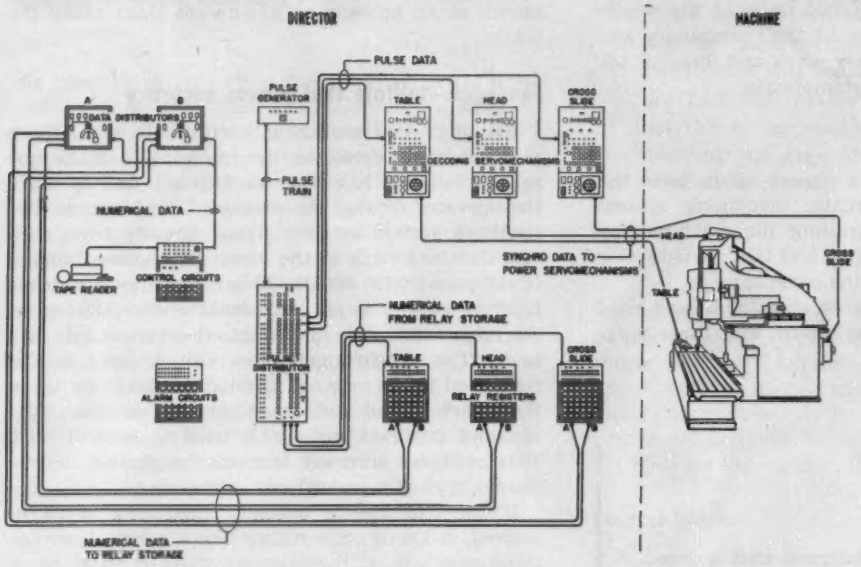
In its application to machine tools, numerical control guides the tool over the work without human intervention in response to a series of instructions previously recorded in the selected code of numerical values. The code may be provided on media such as punched cards, punched paper or plastic tape, magnetic tape, or film. Selection of the code media is determined by the directing device and by the application; not by the control system. In the MIT application, the dimensions of the work and other specifications of the machining process are represented by patterns of holes punched on paper tape.

As a concept of control, this technique is not very complicated. Numbers have always indicated definite values—to the human mind. A specific number of inches, hours, or gallons provides an immediate picture of a standard condition to all who see or hear it. However, when this number must be interpreted by a machine and coordinated with a series of other number-values the operation becomes very complicated, involving digital and analog computations plus servo-mechanisms and electronics. But it is the equipment and the basic engineering that are complex; not the actual operation. And neither the operator nor the manufacturing user need be concerned with technical details.

Numerical control systems may range from simple ratchet drives to complex equation-solving apparatus, depending upon their application. For example, the user (or his designer) may find it best to use a system in which complete machining processes are built out of combinations of as few as three basic instructions: move forward one unit step, move backward one unit step, and stand still. The size of the unit step may be whatever the specification for the smallest machine motion is, perhaps 0.0005 in. Thus each 0.0005-in. increment of a total dimension has a code value of one (1).

Consider a table-positioning machine for which numerical control of this type is provided on two motions: x and y, at right angles to each other. Then, any point on the table can be located by moving in the x and y directions a number of steps equal to the number of half-thousandths of an inch contained in the desired motion. If the part requires an x-motion of 5 in. and a y-motion of 4-in., both forward, there must be a sequence of 10,000 "move forward" code units for x and 8000 "move forward" code units for y. The result is a very long control tape. However, while tape preparation is tedious and time-consuming, the system requires only very simple control apparatus, perhaps an elementary ratchet drive. Instructions are lengthy but the directing equipment is low-cost. Usually, there is an inverse relationship between the length of the instructions necessary to machine a given part and the complexity of the system necessary to execute those instructions. The media used to introduce the code unit to the machine just described is of only secondary importance. It could be 10,000 (and 8000) holes in a punched card or paper tape, 10,000 transparent lines on a photographic film, or 10,000 impulses on a magnetic tape.

Other applications may dictate the use of a design scheme resulting in brief instructions and complex control equipment. For such work as airfoils, characterized by an equation containing only a few constants, it may be best to design a control system, using the same basic technique, which is capable of solving the complex equation by which the work surface is described and of guiding the tool to generate the desired surface. Instructions, then, only need be the constants in the equations; are, therefore, very brief. However, the computer and director will be complex and high-priced. Though designed for more complex work, this equipment could utilize simple tapes for elementary shapes but it is seldom, except in emergencies, that this use would be economical.



NUMERICALLY CONTROLLED MACHINE TOOL and its director equipment, at MIT, appears much more complicated than is actually the case. This is an experimental setup, spread out for study and modification. The same, or better, results are obtainable in a much smaller unit through proper packaging with miniaturization and plug-in components. The schematic drawing describes the components and their arrangement, plus the sequence of control

The fourth dimension...

Most metalworking processes operate in four dimensions: length, width, depth, and time. The first three are commonplace—seen on every blueprint, but the last dimension, though equally important with the others, is frequently overlooked. Yet it, too, is seen on almost every operation sheet. Feeds are measured in units of distance per unit time (sfpm, ipm, mph, fps). Thus, time is a control factor. It might be called the coordinating dimension because, for two or more motions, fixed intervals of time decide where planes will coincide to produce constructive points in space—or where the cutting tool will be. Consequently, time is relative to distance and, given direction, it can be interchangeably used as a measure of distance.

Numerical Control uses "time" as the measure of distance and as the common denominator for all motions. A master clock on the director issues a constant stream of timed electronic impulses. This pulse generator serves as a basic time reference for the entire system and acts as pulse source for the operation of the pulse distributor, which feeds three pulse trains per tape instruction. The three pulse trains control, in coordination, the three machine motions. Each pulse in the MIT machine, is equivalent to 0.0005 in. The rate of pulse supply is determined by the working characteristics of the piece and by machine capabilities.

How numbers control

MIT's electronically controlled machine has three main units. First, the machine itself is a converted 28-in. Cincinnati Hydro-Tel with a 60x30-in. table and 15-in. vertical head motion. It has been adapted for numerical control by adding special servo-drives and feedback instrumentation.

The tape-punching unit is a commercial device made by Flexowriter, normally used for form-letter writing by automatic typewriter.

The machine-tool director is the custom-built unit in the system, and is not available commercially. One could be built to order—at a cost of from $60,000 up, depending on complexity, engineering, added functions, and so on.

These are the three physical units of the whole automatic system. In order of their simplicity and familiarity, here is how they work and dovetail together to machine parts automatically. . . .

The machine

"Numerical control" is a phrase taken from the theory of how the automatic machining system works, and it means controlling the machine "by the numbers," or by counting; and that's where new parts for the milling machine come in.

To adapt the miller, all table, cross-slide, and head drives and controls were removed, and three variable-speed hydraulic transmissions were installed and connected to leadscrews. Their electrical controls, which operate hydraulic valves, are connected to the director.

Each transmission will produce, through gearing and leadscrew, a motion of 0.0005 in. of the table, head, or cross-slide for each electrical pulse received from the director; and all tape and director actions are based on this conversion. Thus, if the director sends through 77 pulses to the head and 24 pulses to the table-traversing control, the head will move 0.0385 in. and the table will traverse 0.0012 in., both at the same time. If no pulse is sent at this time to the cross-slide, it stays as is, and the cutter moves at an upward or downward slant along the work.

Feedback—telltale that proves accuracy

Although this motion is accurate enough, there must be some check on the machine to make absolutely sure it has done as directed, and to warn the operator or stop the machine if it has not. The feedback system sends a signal directly from each machine feed back to the director, where command is compared with result. This is done by a synchro receiver geared to an instrument screw attached to the table (crossslide or head, too) where it acts as a rack. The synchro generates voltage, and this is compared to the original command voltage set up in the director. Any difference between director voltage and feedback voltage is used to control feed. This produces accuracy because the system is constantly trying to cancel out any error.

If the machine is actually producing work *as desired*, it keeps on working like a robot. If something goes wrong, the machine stops or an alarm is indicated. A record of 3% director downtime over many thousands of hours of operating time has been recorded, and about half of this resulted from a design fault in the position coder. A second machine would have a different arrangement that would eliminate this trouble.

How the tape works

Each pulse in the director represents a movement of 0.0005 in., of the head, slide, or table of the milling machine. Actually, in other cases it might be best to make this conversion factor something different; perhaps 0.001 in./pulse for a more economical system or 0.0000001 in./pulse for a highly accurate system. But for the machine at hand, for the work being done in the MIT lab, the factor of 0.0005 in./pulse was worked out as most useful.

On a piece of tape, there are only two conditions that can exist in any given space; either there is a

Error Correction...

The NC director is so designed that a simple error may occur in the tape at any time and the machine will recognize it, ring a bell, rectify it, and keep on going. This is because of a double set of instructions punched on the tape.

If two errors should crop up in the tape in rapid succession, or at the same time, the director will ring the bell and stop. Then the operator may get the director past the bad place in the tape with hand controls, assuming he can see the error and can figure out the right way the tape should have read, or he can get another tape. There should be a duplicate tape handy for any operation—it only requires a little extra automatic work from the tape-preparation unit.

This is probably as close to "thinking" as an automatic producing machine has come so far.

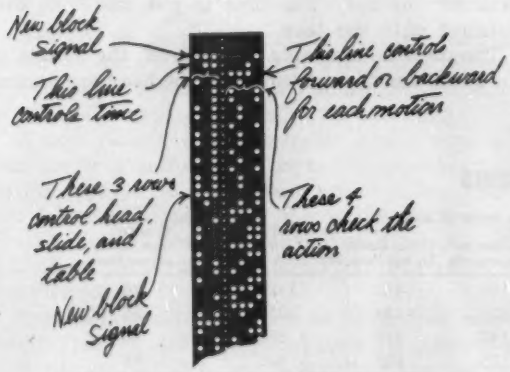
FEEDBACK FOR THE TABLE TRAVERSE starts at instrument screw attached to table, next to machine base. As it moves with table, it rotates feedback equipment that signals table position to director. There, a control transformer detects any variation between table position and where table should be, and sends voltage to table transmission to make up discrepancy

hole punched in the proper spot, or there isn't. Now, to utilize these two conditions, it would be possible to punch 22,500 holes if you wanted the table to move 1.125 in., but this is very impractical.

One solution to the space (and time) problem is to create a code in binary numbers on the paper tape. Binary numbers are somewhat confusing to those who have not worked with them and have no practice, but they are actually simple when used with this sort of tape control.

Thus, the binary number that is equivalent to 1.125 in., which means 22,500 pulses from the director is 101011110000000.

This isn't as bad as it appears, for all the tape-machine operator has to do to produce this number on the tape is to punch; hole, no-hole, hole, no-hole, hole, hole—so on until he has gone past 15 spaces on the tape (because there are 15 digits in this particular number). The result is a row of holes and spaces that will determine the electrical pulses necessary to move the machine table 1.125 in. Actually, the system may be rigged so the operator can type a decimal number, and an automatic coder in the director can convert it into binary form.


New block signal
This line controls time
These 3 rows control head, slide, and table
New block signal
This line controls forward or backward for each motion
These 4 rows check the action

TYPICAL CONTROL-TAPE SECTION

If you're curious about binary numbers...

here is how they work; the system uses the exponents of 2 the same way the decimal system uses the exponents (or powers) of 10.

In the decimal system, $214 = 2\times10^2 + 1\times 10^1 + 4\times10^0$

In the binary system, the same number is, $1\times2^7 + 1\times2^6 + 0\times2^5 + 1\times2^4 + 0\times2^3 + 1\times2^2 + 1\times2^1 + 0\times2^2$, and you write the number by writing down the multipliers in front of each expression, thus—11010110.

Another example is 25.

$2^4 = 16$; 16 from 25 = 9. $2^3 = 8$; 8 from 9 = 1. 2^2 is 4, but you can't subtract 4 from 1, so put down a zero. Same for 2^1, which is 2, so put down another zero. Now $2^0 = 1$, and that evens out the subtractions. Now put down a 1 for each factor that could be subtracted, and a zero for each that couldn't, in order, and you build up the binary number, 11001. It's much like building up gage blocks to provide an exact decimal thickness.

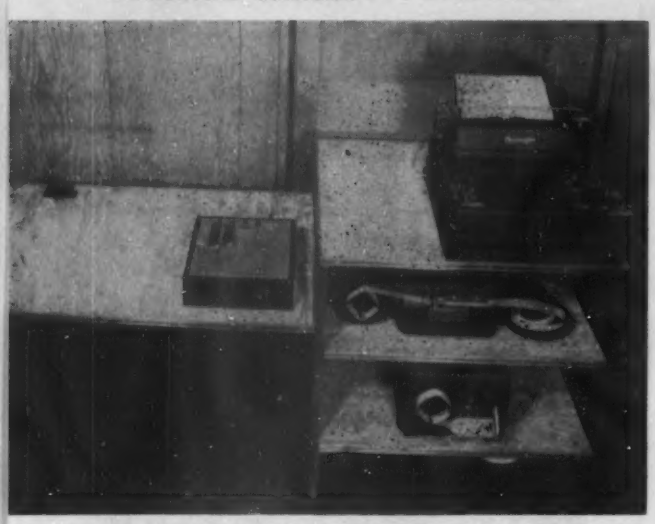
Control blocks

For each different motion of the machine, a block of tape up to 20 hole spacings long is necessary. One line of holes, across the tape, determines the amount of time, in seconds, during which the machine motion is to be made—the feed rate. Therefore, all machine motions are made in the same amount of time, and happen proportionally, so a straight-line cutter motion in any direction at all is possible.

Another row of holes controls whether the motion will be forward or back, a hole indicating forward, no-hole indicating backward, for each of the three machine motions. A third row indicates that this is a block of new commands.

The remaining 17 holes in each row of the block determine the number of pulses, or the distances the machine table, head, and slide move.

Although the "blocks" or sections in the present system are but 20 holes long, they could be longer, and such functions as turning on or off coolant or changing spindle speeds could be easily handled through the machine-tool director.



FLEXOWRITER PUNCHES TAPE RAPIDLY, as operator reads coded, detailed instructions from engineers and works keyboard. Tape may be spliced by running writer automatically from old tape, stopping it just before an unwanted section comes up, hand-typing in a new section, then letting the Flexowriter automatically duplicate the remainder of the tape

TAPE READER runs tape on sprockets as feeler pins push through existing punched holes and actuate precision-switch contacts; other pins cannot push through because there are no holes. Note tape feeder, which allows feeding tape from inside reel—tape never has to be rewound. Tape can also be run in continuous reel for continuous part duplication

Tape-preparation unit

The tape-punching unit is a commercial item. Similar units are made by a number of companies. Because the 7-hole tape in use is more or less standard for teletype and automatic-typewriter use, the equipment and tape are easily obtained.

If the data and instructions that must be punched on the tape refer to a curve or line on the workpiece that can be defined mathematically, it is possible, and often practical, to run calculations through a digital computer to which has been attached a tape-cutting unit, and the result is a punched tape directly from the computer.

Programming

In preparing the data for tape, the engineer must take a part drawing or design calculations and locate the path of the tool center for each cut. This has to be done in detail, including motions at corners where the cutter will change direction, and may run into considerable work. However, junior engineers or draftsmen can do the work, which may be extensive but not particularly difficult.

Starting the first cut, with the work in a fixture and the cutter centered over a reference point on the fixture, the path of the cutter, and therefore the machine motions involved, must be laid out from this point to where the cutter enters the work; and from there to the end of the cut. Given a raw material of a certain hardness, a cutter made of a certain steel, and machine power of a known limit, a process engineer works out the optimum cutting speed, figures the distance, or length of cut, and calculates the total time for the cut. The time is put into code and punched onto the tape.

The distance the table must travel, the motion of the slide, and the movement of the head are figured

Milling-machine tape-preparation programs

Pc for which program prepares tape	No. of library-type subroutines used	Storage breakdowns in terms of single-length registers (16 bit) Library Subroutines	Orders written for particular program	Initial Temp. Storage data, etc.	T o t.	% orders from library subroutines
Supersonic nozzle	9	513	160	453	1126	76
Airfoil templet	14	751	121	183	1055	86
Conical test section	12	608	149	129	886	80
Wing section	13	666	123	137	926	84

LIBRARY OF STANDARD INFORMATION FOR COMPUTER USE is already building up at MIT, and should enlarge greatly in future. This information simplifies computer work for other similar or identical parts, cutting down computer time necessary for new calculations when a new job comes through. These are not tape patterns, but computer routines and sub-routines, which must be utilized before the actual control tape itself can be cut. But if subroutine is available, tape production is quite simple

Steps in computation...

Coding control data Recording control data Feed-rate control data	Steps common to all jobs
Cut-length data Cut-spacing data Tool-center corrections	Steps for which relatively small set of subroutines is adequate
Finding points on surface to be machined	Steps for which some special orders or subroutines usually must be written

THESE GROUPINGS SHOW RELATIVE SUSCEPTIBILITY of various kinds of computing steps to the library-subroutine approach, where subroutines are stored for later computer use, once they have been worked out. Growth of these subroutines into a library of data would make much of the extensive computer work not necessary or much easier and faster

out to the end of the cut, and these distances are changed to binary form and coded into the tape. In addition, the direction of each motion, forward or back, is put into the tape—actually by calling it either plus or minus, and by punching a hole in a particular spot, or by not punching the hole.

Programming, or figuring out the motions the cutter must take to produce the final shape on the work, requires knowledge of the machine tool itself, the power system, and limitations of the controls and the tolerances for the part being machined.

Calculations are essential to allow plotting the position of the cutter each time it must change direction, as on a curve, so subsequent instructions from the tape and director to the machine will be correct.

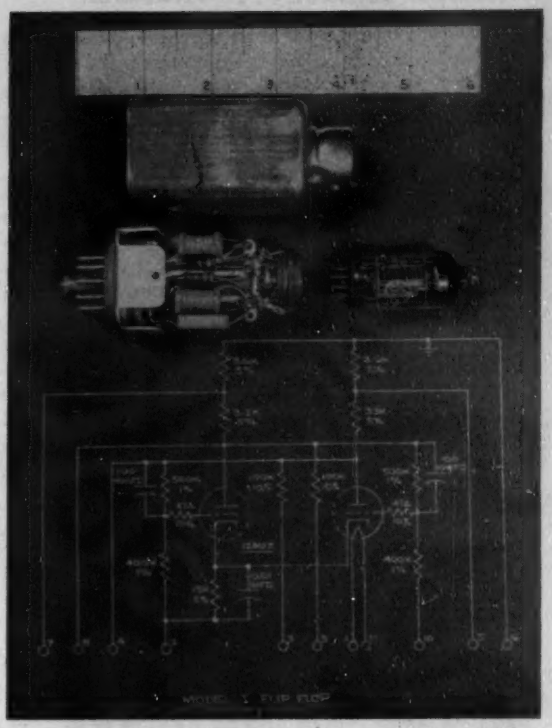
The director

Heart of the numerical-control system is the electronic director, a complex unit with about 250 electron tubes, 175 relays, and 280 pilot lights (of which only about 25 are of concern to the operator).

A tape reader, with a sprocket wheel, runs tape past feeler pins that make contact if there are holes in the tape, or do not if there are no holes. This is the basic information for the whole system, and must be handled by the control circuit, which starts and stops the reader as information is required by the director.

Beyond the control unit are two data distributors, which feed the electrical pulses from the tape reader into storage registers, made up of relays that are capable of holding electrical charges that represent control numbers until they are needed to control the machine.

Two data storage registers, called A and B, are provided for each machine motion—table traverse,



FLIP-FLOP CIRCUIT, tube, and wired-up sub-chassis is one of many used in director for counting. These are all standard parts and tubes; this particular circuit is a natural for potting or printing

CORNER OF DIRECTOR where simple circuits are duplicated in large numbers. Only non-commercial item is decoder wheel (right center), which could be machined from solid or cast. Under most of the tubes are plug-in circuits that contain most of the circuit components; behind them are mainly connecting wires that presumably would never need repair except for external damage like a plant fire

cross-slide motion, and head elevation. While the machine is moving in a path dictated by a number of pulses from one register, the other register is being filled from the tape for the next machine instructions. Thus, the machine never needs to stop for lack of information.

Farther back in the director is a clock oscillator that operates at 4096 pulses per sec. Depending on the numerical count for any given motion, the pulses from the oscillator are counted out over the required period of time by the pulse distributor. This part of the director proportions out the pulses for the three machine feeds so all will start and stop at the same time.

There are three decoding servomechanisms, one for each axis of the machine, that receive the timed pulses and change these pulses into the voltages that actually operate the machine-feed transmissions.

Safety

There are alarm circuits, checking circuits, feedback circuits, and many other safety mechanisms within the director; all contributing to perfect operation and making the danger of damage to the machine or work quite slight.

Possibilities

This is true electronic machine control, not just electronic motor control, which is not too uncommon in some machine shops today. The machine-tool director, as built at MIT, controls feeds in three directions, forward and backward, and also cutting speed.

However, the present system, including its electrical circuits and physical arrangements, is by no means the only way to do the job. There are a number of features that are subject to further development; and it is quite possible that completely different theories on machine-tool control may be worked out. It is theoretically possible to control a machine with all mechanical, hydraulic, or pneumatic devices, all coordinated to work together. But the speed, reliability, accuracy, and versatility of electronics will probably be too useful to avoid, and chances are great that future machine-tool controls will be heavy in electronics and electrical mechanisms, and light in strictly mechanical devices.

What computers contribute

Science-fiction writers have built up electronic computers in glowing prose; ones that could think and do things no mortal could. But a conventional digital computer simply does mathematical work—adding, subtracting, multiplying, dividing, and some more complex operations. Computers, at least as we know them today, have no initiative.

The value of a digital computer is in speed and accuracy; in these advantages lie any economies and labor savings that may be obtained. If a part can be designed, then it can be programmed, and information for the tape can be calculated. If any of this calculating can be done on a computer, then you may be able to cut expenses sharply.

Of course the computer itself is expensive, so it must be kept busy a good part of the time so it can earn its keep. For this reason, only the larger metalworking companies will be able to justify computers for programming in the near future.

Cutting down the cost of computations

After two years of experience with its numerically controlled milling machine, MIT has piled up a library of what computing engineers call "subroutines." These are the questions and answers for a number of minor operations that crop up every once in a while when computations are made at the automatic computer. A complete routine is a tape that controls the machine as it does a specific operation.

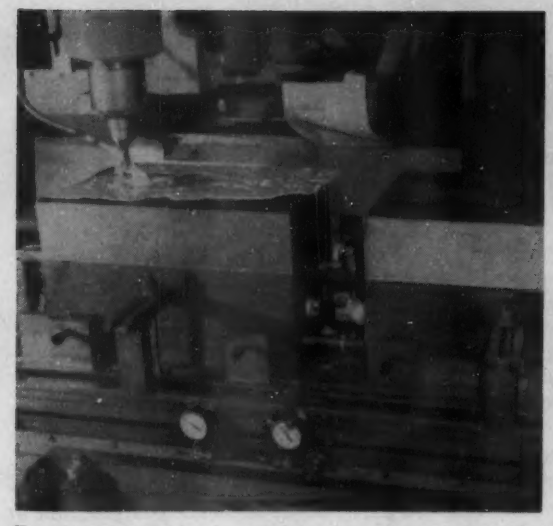
When a similar or identical operation comes up again when a new job is being worked out, the engineers can pull a subroutine from the library, substitute the results already worked out during an earlier computation, then go on to more complex work. It saves time, computer operation, and manhours; there is no sense in recomputing if you already have the answer, obtained for an earlier job.

A company owning or renting a computer to work out the data for tape preparation can do the same thing; and a company using a computer often enough could surely develop a considerable library after a few months of operation.

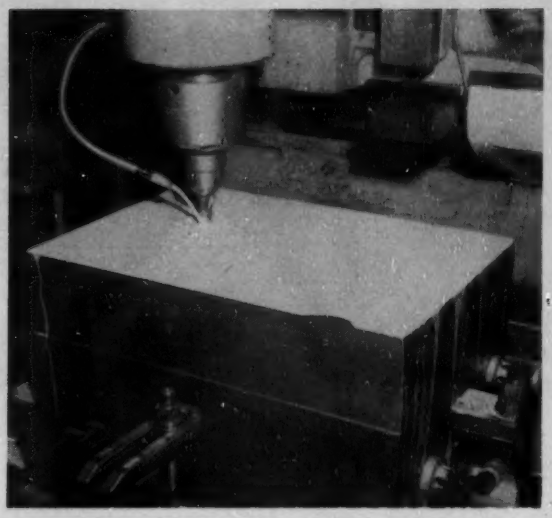
It's a cost-cutter that might make numerical control less expensive in some cases, and make it actually possible in other borderline cases. You can rent computer time now for something around $400 a day, or buy a complete computer for about $150,000 or $180,000. By using a library of subroutines you can cut computer time quite sharply.

With subroutines, it is possible to add other specific information concerning the job at hand, then throw in factors concerning the particular machine tool on which the job will run, and come out with a computer tape that can be fed to the machine-tool director.

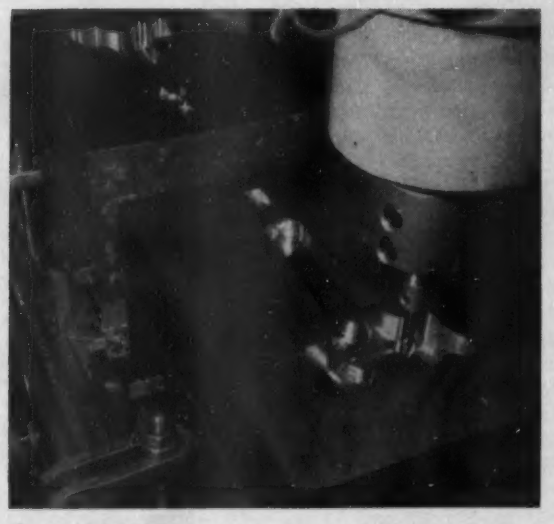
As indicated by the tables, a single machine tool can be operated with a large percentage of library subroutines for various kinds of jobs. The larger the library, the better the percentage. Also, the more economically can the tape be produced. It may be that standard tapes will be purchasable.



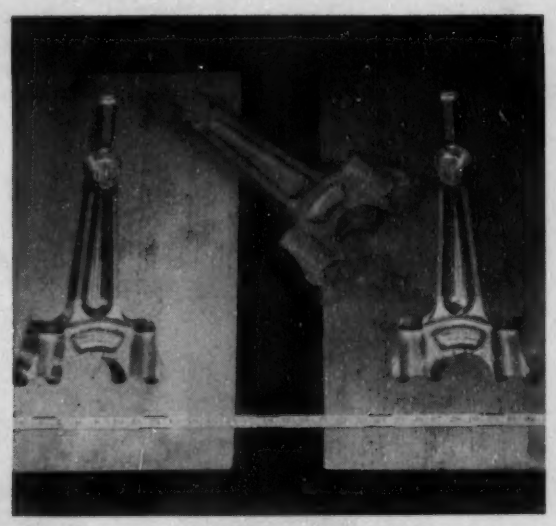
1 **DIE-BLOCK SETUP** was made flat on machine table, with block edges set against locating pads



2 **CUTTING WAS DONE WET,** which speeded work; allowed best combination of feeds and speeds, and reduced cutter wear by 75%. No templet checks were necessary



3 **FINAL CAVITIES** were perfect images of each other. No other result is possible—same tape was used for four cut patterns



4 **CHECK ROD,** made by pouring no-shrink composition material into die cavity from earlier run, fitted new dies exactly

Die sinking is fairly simple

A sample die cut by numerical control at MIT was for forging aircraft master piston rods for radial engines. Here, the advantage of symmetry was utilized—in conventional machining this is not always possible.

There were two mating dies (identical), with symmetrical sides. Four cavity halves were the same, except that two were mirror images of the others. One tape did quadruple duty because it was reversed to control the cuts for opposite cavity halves.

Programming time was 176 man-hr, and computations and tape preparation took 176 man-hr. Setup time for a pair of dies, two cavities, was 3 hr, and machining time was 39 hr. Control principle permits machine operation to complete job without stopping—except to change cutter.

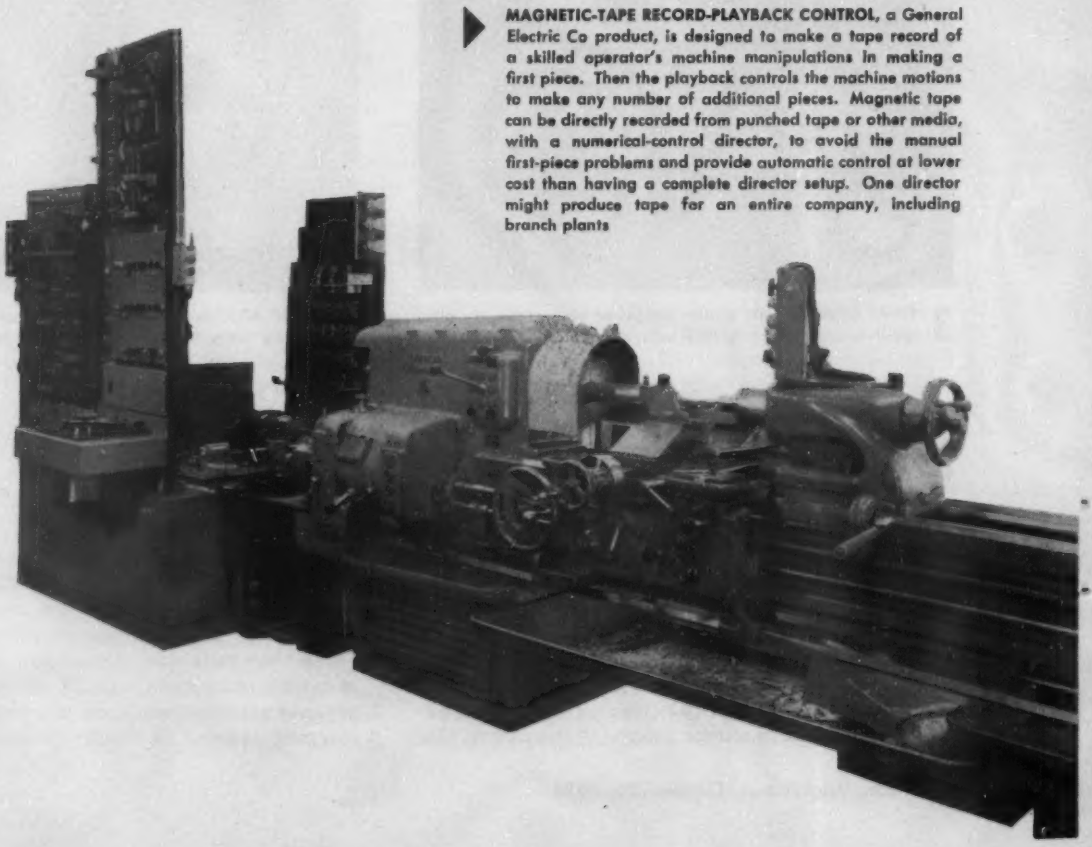
Information processing . . .

Here is an expression well worth learning. It does not describe a new principle, but, rather, provides a succinct description for a process used in every walk of life since man began making things. *Information processing* describes the orderly arrangement of steps which must take place from conception to creation of a product. This plan may result from experience, from educated guesses, or from scientific calculation—by linear programming through operations research. The results may vary with the method but the term is equally descriptive.

Regardless of the nature of a product, it starts with an idea. Then someone gives that idea form by providing a design and a set of specifications. To obtain a product, the design and specifications are studied and manufacturing methods are selected. If, for example, the desired product is a metal part, perhaps fixtures will be selected and designed; tools will be selected and designed or assigned; then the work will be scheduled. Finally, drawings and operation sheets will be given to the machinists or operators and the part will be created. The program of action from design through operation of the manufacturing method is *information processing*. If these steps are considered a part of a *process*, then definite optimum patterns should result.

Programming

The process of obtaining and arranging information for use by a numerical control system is called "programming." Basic programming, when this con-



MAGNETIC-TAPE RECORD-PLAYBACK CONTROL, a General Electric Co product, is designed to make a tape record of a skilled operator's machine manipulations in making a first piece. Then the playback controls the machine motions to make any number of additional pieces. Magnetic tape can be directly recorded from punched tape or other media, with a numerical-control director, to avoid the manual first-piece problems and provide automatic control at lower cost than having a complete director setup. One director might produce tape for an entire company, including branch plants

trol system is used for machine tools, consists of three operations:

1. The usual part design and specifications, methods planning, fixture design, tool design, and work scheduling must be done.

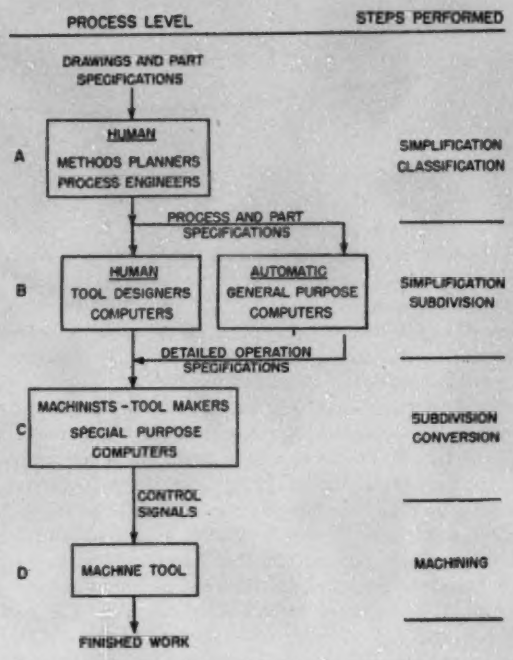
2. The path of the tool over the work, determined during the first step, must be described in terms of the machine's motions and means of measurement.

3. The information, step No. 2, which describes the tool path must be translated into the proper language for the machine which, in the MIT miller, is punched paper tape. The latter is called the information media.

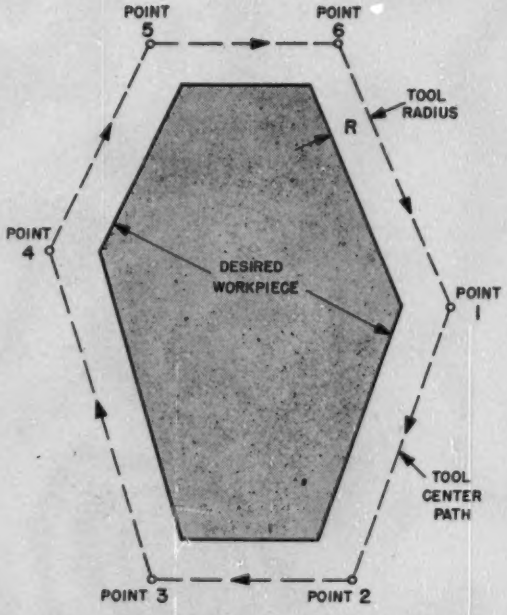
While step No. 1 is generally similar to conventional practice, the improved flexibility of numerical control creates several important differences. First, the alert methods man is given a greatly expanded opportunity for ingenious scheduling of operations to minimize human intervention during the machining process. Also, the inventor or designer is released from the restriction of "straight lines and circles"; is free to develop parts having ideal engineering characteristics. However, tolerance limits of the machine tool to be used are still a design factor. Machining problems and costs will rise sharply at the point where design specifications require closer control than is available in the machine. While there is no practical limit to the control accuracy that can be built into a director, it is economically impractical to build a director that is much more accurate than the machine it controls. Nevertheless, the machine will repeat very closely within that limit. The MIT milling machine operates within a total tolerance of 0.002- to 0.004-in. But the *deviations are not cumulative* from information block to information block along the tape. Second, the machine operator cannot be expected to catch and correct errors made in programming. Hence there is greater pressure upon the programmer (tool or methods engineer) because his instructions will be followed exactly by an accurate but unintelligent machine with no skilled operator to catch errors, if present. However, several procedures have been developed to catch and correct many of the possible programming errors before they result in damaged tools, fixtures, or work. One facility of the machine director provides that, when a simple illogical command is introduced by the tape, the director will either correct for it or shut itself off.

Methods planning must result in a complete set of operation sheets, much like conventional practice, which detail the sequence of operations, the number of tool passes, the amounts of material to be removed at each pass, the finished dimensions of the piece, the dimensions of the blank, the type and size of tools required, the fixtures required, special techniques necessary to machine the given material or design characteristics and whatever other information may be required to *completely* describe the machining process to be performed by the numerically controlled tool.

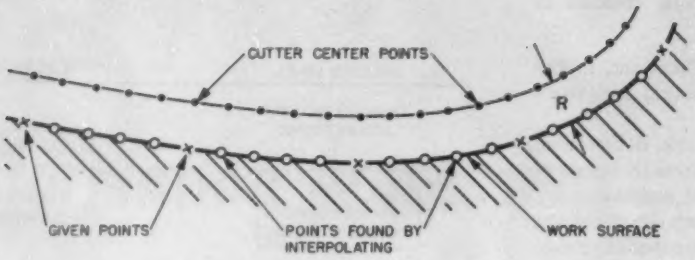
The second step is to translate the methods information into numbers. Because, for each pulse, the



Machine-tool system block diagram



TOOL-CENTER PATH for piece bounded by straight lines, using cylindrical milling cutter. Offsets for continuous curves in any plane parallel to two machine axes reduce to this form, as shown by the concave and convex curves

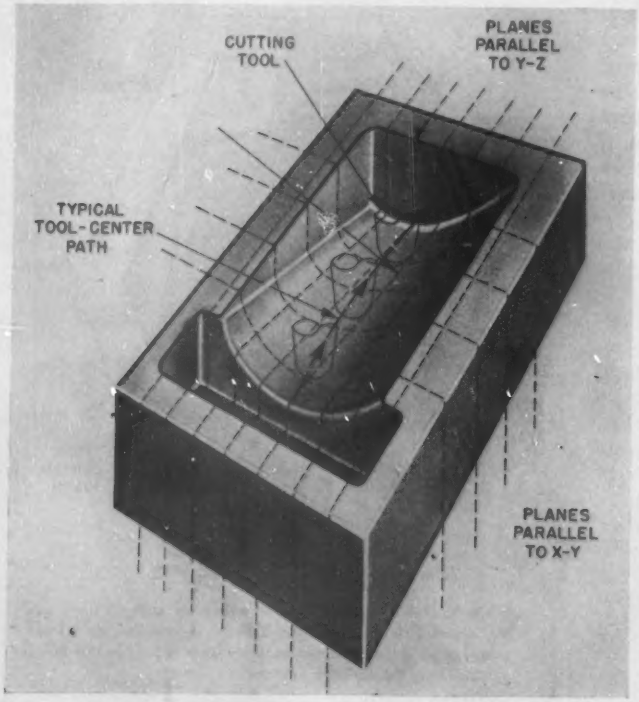


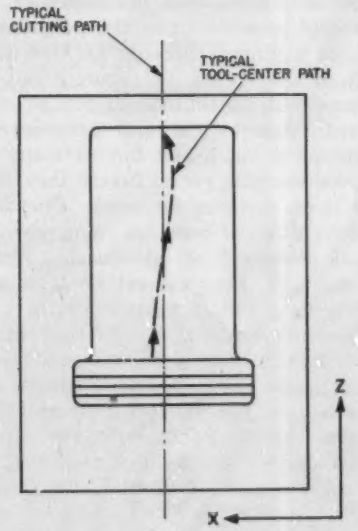
POINTS ARE INTERPOLATED between given points when curves are defined by the latter. Curve always results from a series of straight-line increments; some as short as 0.0005 in., or the chord of a 1° arc

motion of the tool relative to the work is always a straight line, work surfaces are approximated by a series of straight-line cuts. (Remember, the shortest straight line on the MIT machine is 0.0005-in. long, and shorter lengths are possible on equipment requiring greater accuracy.) By an appropriate choice of such cuts, any surface may be generated within an accuracy consistent with the limits imposed by the machine tool and the data accuracy.

In numerical translation, the three orthogonal axes along which the machine moves are called, for convenience, X, Y, and Z. The X axis is taken in the direction of table motion, the Y axis in the direction of head motion, and the Z axis in the direction of cross-slide motion. Information on the tape is divided into blocks, with each block containing complete information for one straight-line movement of each of the three axes—in other words, of the tool relative to the work. Thus tool movement is the resultant of the machine axes' motion. Each block contains seven "commands," four of which are numbers. Three of these numbers are called "machine orders", Δx, Δy, and Δz, which are the numbers of of half-thousandths of an inch (or other predetermined increment) in the desired motion of each axis. The fourth number, called "clock-cycle time," indicates how long a time the motion is to require. The latter is chosen in accordance with the magnitude of the machine orders and the feed rate desired. Direction, forward or reverse, for each of the three motions, is indicated by the remaining three commands. Other commands can be included for auxiliary functions or for checking.

Because the motion of any axis is specified, for the MIT machine, to the nearest half-thousandth of an inch, the space through which the tool moves may be visualized as divided into cubes one-half thousandth of an inch on a side. Thus, the machine "commands" cause the tool center to move from the cube it occupied at the start of the motion to another cube at a precise distance and location from the first. However, the *exact position* of the tool *center* in each cube is indeterminate. But this indeterminacy is never accumulated over a series of cubes or cuts. As a consequence, *command accuracy* is always within 0.0005 in. This is adequate for a machine





CURVES formed by the intersections of a surface with a series of planes are shown by this turbine-blade forging die. Cutting-tool center follows the path shown. Extremely complex curves can be machined with mathematical accuracy by numerical control

expected to hold tolerances of only 0.002 to 0.004 in. Closer control, for more precise machines, is provided by building additional electronic stages into the director, to permit using smaller distance increments per pulse, for example, 0.0001 in., 0.00005 in., or 0.00001 in., etc.

Cutter-center offsets

It can be seen that the portion of the tool where cutting occurs may shift as the direction of cutting changes. Because the cutter-center motion is the motion specified in programming, it is necessary to compute the cutter-center path that will result in the desired work surface. Thus the tool geometry requires what is called *cutter-center offsets* or *cutter-center corrections*. For example, when plane curves which form the edges of templets or cams are milled, a cylindrical tool is used. As each tool motion is a straight line, the path of the tool center, within 0.0005 in., will be a series of straight lines parallel to the lines used to approximate the curve, and displaced from them a distance equal to the tool radius. These offsets are the amounts along each axis that the cutter-center is displaced, from the point of tangency between the cutter and the work surface. The cutter-center locus for a curve is another curve, parallel to the one to be cut and spaced one tool radius away from it.

In computing orders for surfaces, parallel surfaces, rather than parallel curves, are involved. For other than horizontal or vertical surfaces, the tool selected is usually a ball endmill. The reason: A line perpendicular to the surface being generated at the point of contact with the tool *always* passes through the center of the spherical cutting surface of the tool. The tool centers lie on a surface parallel to the one being cut and separated from it by the tool radius.

Note: one major consideration at this point in development, is tool wear. Tools must be accurately ground and must be kept sharp. It is not possible to compensate for tool wear within the director, but only by reprogramming the job for the new cutter-center offset and preparing a new tape. Hence frequency of tool change is determined by the accuracy requirements of the work. Of course, cutters can be reground to a smaller diameter and used for other programs. (It is possible that something, such as an automatically indexing turret toolholder, will be developed to introduce a new tool when this is necessary.)

Final result of the numerical work is a *dimensional table* which shows the points through which the tool center should move to produce the work. It provides a series of X-axis, Y-axis, and Z-axis coordinates referred to the starting point of the program. It includes *every* motion of the cutter spindle relative to the work, such as stops for tool changes, traversals away from work, rough cuts, finish cuts, and clearance for hold-downs. It also includes instructions covering the feed rates originated by the methods planner.

Primary process variables...

First step in any Numerical Control system study is determination of the basic control requirements. Typical questions include:

1.. What are the basic types of workpieces being produced?
- **a. What kinds of shapes do they have?**
- **b. What sizes are they?**
- **c. What materials must be worked?**
- **d. What accuracy is required?**
- **e What quantity of each part is made at one time?**
- **f. How many different parts are made?**
- **g. How does the peak production load compare with the average load?**

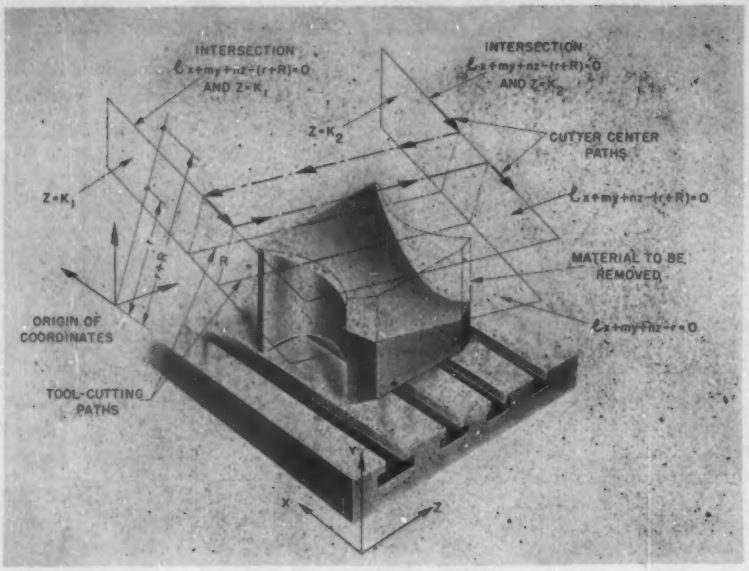
2.. What basic machine tool or tools are contemplated?
- **a. How fast are the tools?**
- **b. How accurate are they?**
- **c. How many motions must be controlled?**
  - **a) sequentially**
  - **b) simultaneously**
- **d. At what rate is new information required during the maching process?**
- **e. What is the coordinate system?**

3.. What kind of information process is involved?
- **a. What is the starting point?**
  - **a) Drawings**
  - **b) Models**
  - **c) Loft drawings**
  - **d) Equations**
- **b. How are the data processed?**
  - **a) Routine operations**
  - **b) Non-routine operations**
- **c. To what extent is general-purpose computing equipment applicable?**
- **d. What general-purpose computing equipment is available?**
- **e Is any form of tape or record-playback control available?**

Last step in programming is conversion of the tool-center coordinates and the feed rates into tape. This is a purely clerical operation which can be performed automatically or by hand. Usually, where the data result from manual calculations, it will be more efficient to code the data and punch the tape by hand, than to prepare them for automatic computation, but the choice depends upon the job at hand and the equipment available.

Methods and tool planning

Differences between numerically controlled machines and conventional machine tools are entirely restricted to the control system. Thus the basic met-



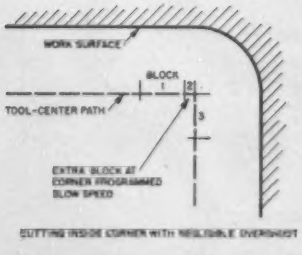
CALCULATIONS FOR A PLANE to be cut on an irregular piece. One setup and a single tape will produce this piece from a cubical block of material, if necessary. Of course, preliminary roughing with a bandsaw would save time

al-cutting problems encountered in the use of any machine tool are also to be expected in numerically controlled machines. All of the problems, that is, except those of coordination and control. Methods planning for these machines, therefore, consists of combining the present techniques for efficient production of machined parts with the special flexibility of the numerically controlled tool so that the work is efficiently produced, with the fewest number of setups, fixtures, tools, and tool changes. Here are some of the special techniques required for numerically controlled manufacturing.

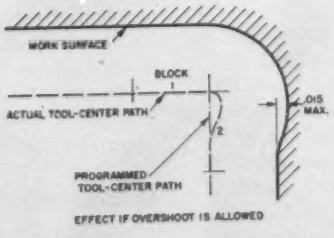
One of the first discoveries of a new programmer is that numerical control gives him the entire responsibility for the finished piece. He must apply his experience and judgment to the problem of maching a piece to a definite end shape, and the only proof of the accuracy of his work is the finished piece. After his work, all of the subsequent programming operations are purely mathematical, hence they yield to mathematical checking. But at present, there is *no* mathematics to prove out metal cutting or the methods planner's art. Just a few programming jobs will make "men out of boys" and even the most experienced tool and methods engineers will find a challenge and an education, together with new horizons of accomplishment, in the responsibility for programming a complex part. And the knowledge gained will improve every conventional tooling job that may be done thereafter.

Some of the conventional machining problems which take on a special interest include:

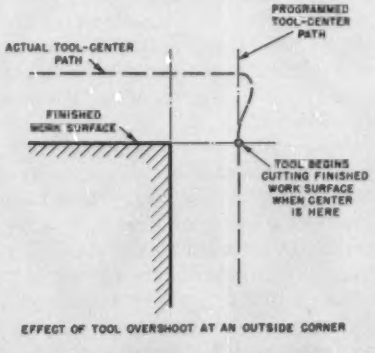
Fixtures, which take on more importance because the machine now has the ability to perform many operations without changing the setup. This factor so reduces total operating time that loading and unloading time becomes a large part of the total. Thus there is added incentive for improving fixtures to permit a greater percentage of actual cutting time. Also, fixtures usually can be simpler than in



CUTTING INSIDE CORNER WITH NEGLIGIBLE OVERSHOOT



EFFECT IF OVERSHOOT IS ALLOWED


PROGRAMMED TOOL-CENTER PATH
ACTUAL TOOL-CENTER PATH
FINISHED WORK SURFACE
TOOL BEGINS CUTTING FINISHED WORK SURFACE WHEN CENTER IS HERE

EFFECT OF TOOL OVERSHOOT AT AN OUTSIDE CORNER

EFFECT OF OVERSHOOTING if too rapid cutter approach to corner is permitted. By slowing feed from 15 ipm to 0.010 ipm for 2 sec, through programming in an extra command block, overshoot is negligible. Overshoot at an outside corner does no harm and is immediately corrected by the next information block, which takes the cutter in the new direction

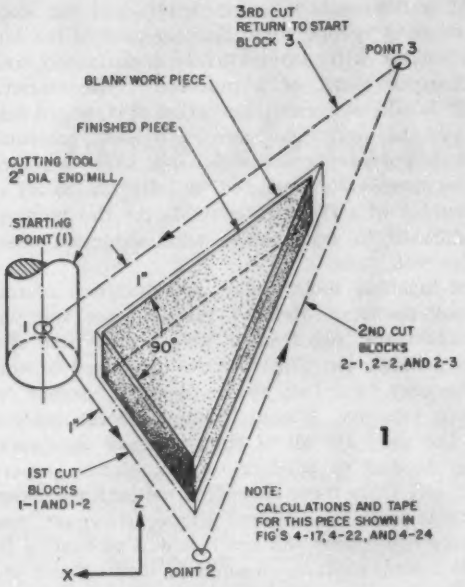
COMPUTATION OF ORDERS FOR SAMPLE PIECE OF FIG. 4-18

OPERATION	CUTTER-CENTER COORDINATES THOUSANDTHS	Δ THOUSANDTHS	Δ HALF THOUSANDTHS	TIME	INCREMENT NUMBER
	3980				
	0				
1ST CUT	3167.5	-4551.5	-9103		
	-371.5	0	0	24	1
	0	-5424	-10848		
2ND CUT	-2256.5	-2228.5	-4457		
	-2800	0	0	44	2
	0	1113	22226		
3RD CUT	8870.5	6780	13560		
	3980	0	0	32	3
	0	-5685	-11370		
	3167.5				

INCREMENT BREAKDOWN

1	T	2	T	3	T	4	T	5	T
-6813		-2230							
0	16	0	8						
-6191		-2657							
-3765		-821		-351					
0	32	0	8	0	4				
10383		4095		1748					

2



1

NOTE:
CALCULATIONS AND TAPE FOR THIS PIECE SHOWN IN FIG'S 4-17, 4-22, AND 4-24

Elements of programming for a sample piece

1 . . Part is methodized and a 2-in.-dia cylindrical cutter is specified.

2 . . Orders are computed.

3 . . Then orders are coded into the tape system from octal commands (might be binary commands).

4 . . Tape is punched. Tape shown contains all of the information necessary to complete this job

CODING OF ORDERS FOR SAMPLE PIECE OF FIG. 4-18

+=1
-=0

			TIME (Sec) CODE	TIME (Sec) CODE
0=000	4=100		2 ——— 0	32 ——— 4
1=001	5=101		4 ——— 1	64 ——— 5
2=010	6=110		8 ——— 2	128 ——— 6
3=011	7=111		16 ——— 3	256 ——— 7

INCREMENT NUMBER	OCTAL COMMANDS 32,768	4,096	512	64	8	1	-	TAPE CODE 32,768	4,096	512	64	8	1	SIGN	TIME
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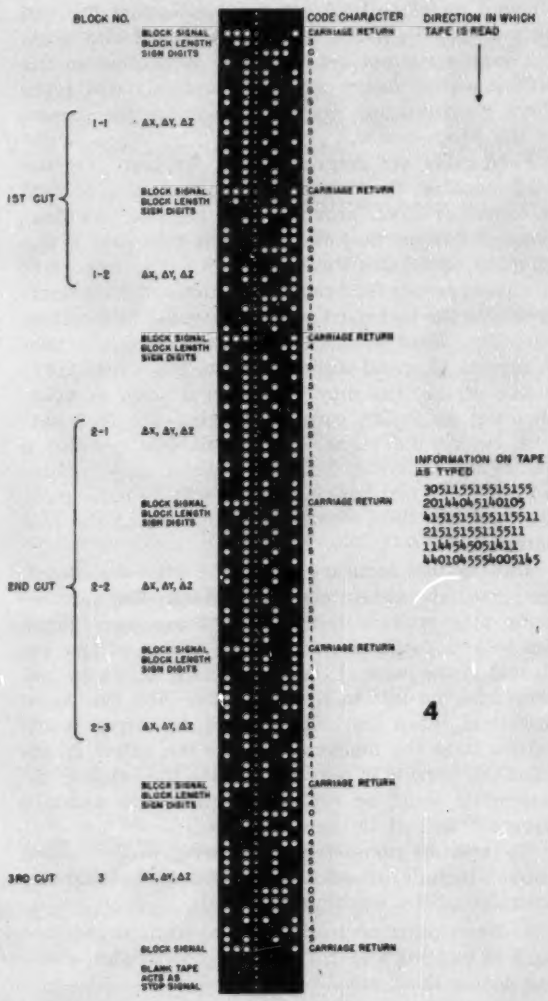


INFORMATION ON TAPE AS TYPED

3051155155155155
2014404514010 5
4151515155115511
215151551155 11
1144545051411
4401045554005145

4

conventional practice because the control takes over many of the functions formerly done by them.

Clamps, hold-down screws, jacks, and similar furniture must be located with special care to avoid interference with the work program. Because it is practical to machine many surfaces of a piece without moving the piece, unusual clamping arrangements are often required to prevent interference between the tool and the clamps. For instance, clamps can be arranged to automatically retract as the tool progresses; then engage after it passes—guided by the tape.

Distortion, as in conventional machining, of the piece while being machined must be allowed for. Rough cuts, especially in forgings and castings, must be taken all over complicated pieces before finish cuts are taken. Load distortions of the piece, the tool, and the machine must be taken into account. While it is possible to program a job without considering these items, then correct the tape after the first piece has been inspected, it usually is more efficient to allow for distortions and correct the tape only where the allowance is in error.

Cutting speeds must be specified to accomplish efficient metal cutting without overloading the tool or workpiece. While the spindle speed and coolant supply are not automatically controlled on the MIT machine, future machines probably will place these functions and many others under the control of the programmer.

Feed rates are determined by the tape. On the MIT machine, three spaces at the beginning of each information block provide eight possible combinations of hole or no-hole to permit selection of one of eight feed rates for that block. It is important to choose proper feed rates at all times, but especially where the tool must change its speed or direction abruptly. Here tool actions must be carefuly programmed to avoid difficulty from the various dynamic errors that may be expected, such as overshooting an inside corner. Slowing the feed rate just before the corner is reached will prevent a damaging undercut. Future machines may include a system for fast braking which will be more positive and less time consuming than slowing the feed rate.

Cutting tool accuracy cannot be overemphasized; they must be accurately specified. As the calculations that produce the tape data are based upon the tool radius, any error in tocl radius will be reflected in the work. Choice of cutting tools may not, therefore, be left to the machinist. Nor can he at any time, when the tool is dulled, resharpen it and return it to the machine. Unless the cutter is adjustable, once it is reground under the original diameter it must be returned to stock to await a program to suit its new diameter.

To facilitate complete programming, process sheets should include, in addition to a step-by-step description of the machining process:

1. Description of preliminary operations required such as locating and drilling hold-down holes, scribing center lines, etc.
2. Fixtures plus purpose of special features
3. Types and sizes of cutting tools
4. Directions for loading work in workholders
5. Spindle speed required
6. Clock setting (normally 1.00)
7. Set-up, or zero, point for each operation, plus intermediate check points for long processes.

Machine-tool design

Just as product designers will have to adjust their point of view, and their thinking, from the limitations of designing for manually controlled manufacturing to the product possibilities with automatic control, so the machine tool designers will find some new concepts to cope with. Replacement of the human operator with automatically coordinated control changes much of a machine's characteristic styling. While, at present, operation of standard machine tools by numerical control is entirely practical, future requirements will demand that machine tools be specifically designed to fully utilize all of the benefits of automatic control. At the moment it is difficult to say exactly what direction these changes will take.

Most machine tools, today, are designed around a human operator. Remove the operator and you can remove the legs from a lathe or the base of a miller, grinder, etc. Thus the machine need be only a few inches to a foot above the floor, except for swing or capacity. Eliminate hand control and you erase the need for all of the auxiliary equipment that is needed to produce angles, circles, tapers, curves, etc. Only three basic feed motions are necessary to produce any desired shape. However, new auxiliary equipment and *controls* will be needed for spindle speed, coolant, inspection, loading and unloading, clamping, changing tools, chip removal, and many other tasks. With the operator unnecessary, why should hand controls be grouped, with all of the attendant design problems? Generally speaking machine-tool design will branch away from the human operator as its focal point and will place greater emphasis on the work and on the control functions as the focal point.

On the MIT experimental milling machine, a basically conventional machine tool, most of the drives and servos are external. A machine designed for automatic control probably would have them housed within its structure. Many of the facilities provided on the machine for normal use are unnecessary and some of the mechanical components, entirely satisfactory for conventional operation, created problems in automatic control. Feedscrews required reworking and additional support, for one thing. And table alignment had to be refined.

Management and engineers will find, as the authors are finding, that it is a major task to convert one's thinking from the routine, commonplace, and habit-ridden standards of current practice to the totally different concept of truly automatic control—with all of its contingencies. We are at the doorway to a momentous era in history, when man makes the machine his lieutenant.

Round Table

Slide-Rule Foremen

"What do you think of the slip-stick genius they made foreman in assembly, Al? I hear he's quite a guy."

"I haven't met him yet, Ed, but I do think it's a good idea to make foremen out of engineers, when it's possible."

"Then the shop will be *all* confusion, not just half confused, like it is now. Why, those engineers don't know the first thing about a shop operation, Al. How can they possibly make decent foremen if they can't tell a socket wrench from a pipe wrench?"

"You might be surprised, Ed. I had a friend who was an engineer-foreman, and he was a crackerjack. He had to take a lot of shop courses in school, and he knew plenty about the shop, even before he started."

"Listen, don't tell me about how much engineers know! How come we have so much trouble with our own engineering department if they're so bright? Those dopes upstairs don't know the first thing about production."

"Well, I think a lot of our troubles are caused by different viewpoints of the same goal—making products. If the engineer is in the shop all day, how can he help but develop a shop viewpoint; just like you and I have?"

"But how is he going to instruct his men when they have trouble? You can't make up for experience with a schoolbook."

"No, but you can with common sense, Ed. How often have you had to guess at an answer to one of your men's questions, hoping it was right, but not knowing for sure?"

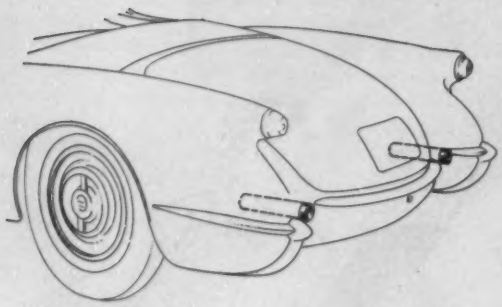
"Sure, but I've rubbed my nose in the shop for years, Al. That gives you a lot of—well, you might call it 'savvy'—that an engineer couldn't possibly have."

"Why couldn't he, Ed? Maybe this guy worked every summer, between school terms, in a shop. Maybe he knows more about screwdrivers and air wrenches than Old Man Dixon ever knew. After all, each man is a different case, and you have to judge him individually."

"But that doesn't prove an engineer is necessarily any good as a foreman."

"And it doesn't prove he isn't either, Ed. Why not wait and see if he works it out?"

***WHAT'S** your opinion of engineers working as shop foremen? Can they overcome the lack of shop experience by applying school learning, or are they automatically no good because they've "wasted time" in class? Your ideas may aid others. Discussions of earlier topics appear on later pages*



Ten steps make sports-car tailpipes

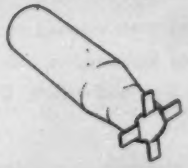
CARL KOONTER, plant manager,
GEORGE C KNIGHT CO, DETROIT

The first use of stainless-steel tubing for the entire extension assembly muffler and tailpipe on a car is for a current American sports car. Fabricating is unusual because a large number of operations are required; both because of design and because of the material.

Raw stock is 304 (18-8) stainless from Carpenter Steel Co, comes in as 2½-in. tubing with a 0.032-in. wall, and is cut to 13⅜-in. lengths. First six operations are pictured; after these, the tailpipes are given baffle plates, which are spotwelded into place, buffed twice, then resonators are added.

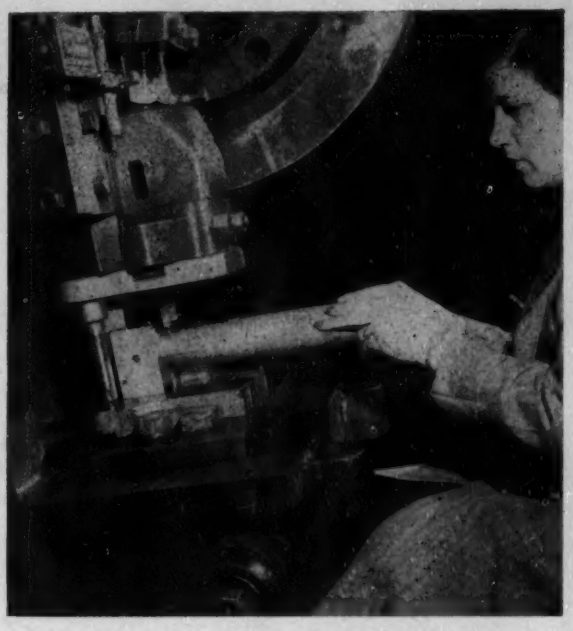
Stainless gives them resistance to chemical attack, rust, and corrosion, and holds up better than plain carbon steel to exhaust gases and street salt as well as temperatures up to 800F. In this application, stainless was not a replacement, but was designed into the original plan.

FIRST STEP IS NECKING DOWN one end from original 2½-in. OD to 2¼ in. for 3½-in. length. Slow, even stroke is essential to prevent work-hardening heat in the stainless, so press is hydraulic.

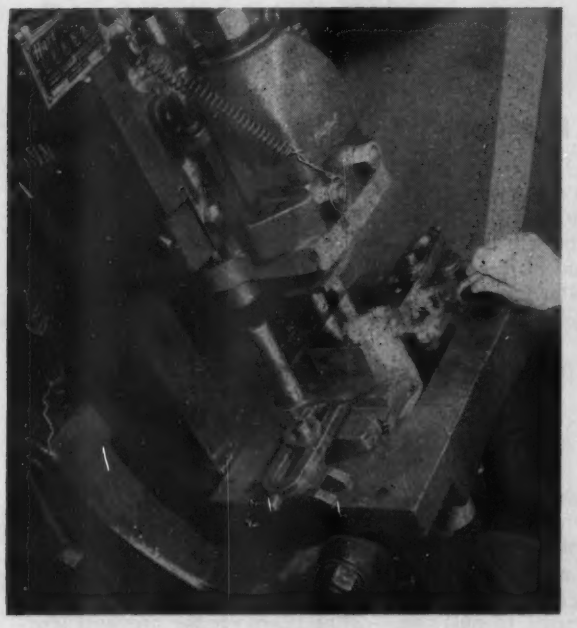


TABS ARE FLATTENED, then flared to 45°, then to 90° in mechanical press

OPPOSITE END IS CURLED over to a 2⅛-in. ID in another hydraulic press. Dies for necking and polishing are chrome-plated and highly polished to minimize resistance and prevent capsizing the tubes



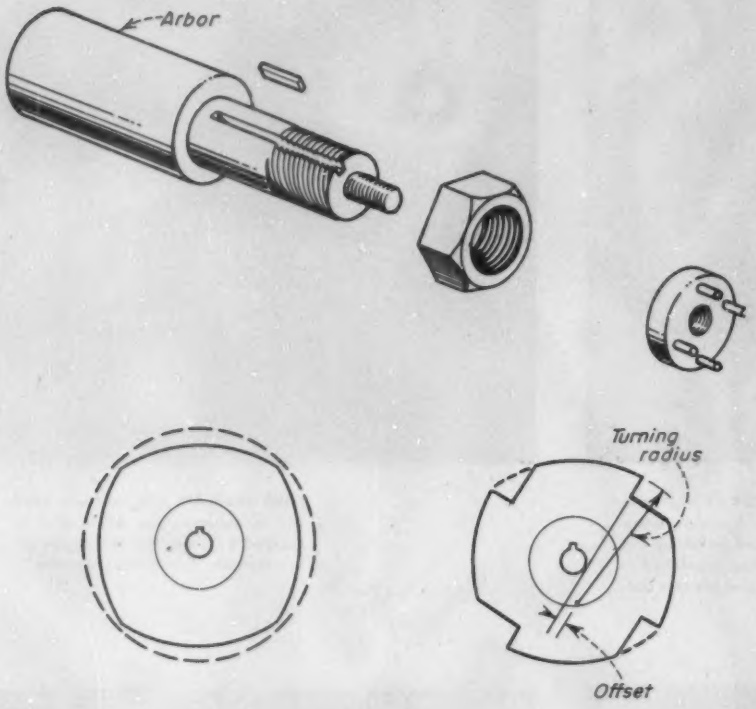
FOUR TABS ARE CUT on small tube end in 4-station die, where tube is indexed by hand. Operations are all at relatively low production rate



SINGLE PUNCH PIERCES TABS in succession. Die pin locates tab edge, and operator indexes tube between strokes

EXHAUST HOLE IS NOTCHED on mandrel die in mechanical press. Hole is 3 x 2 in., is necessary to both let out engine backpressure and produce satisfying exhaust roar. Remaining steps (not shown) include adding a baffle and polishing

Practical Ideas . . .



Offset Turning Relieves Form Cutters

We occasionally need form-milling cutters, but do not keep the equipment for relieving them. Accordingly, we have developed an easy and inexpensive way to provide radial relief, so each tooth can be reground without losing its form.

To do this we have an arbor, as shown, which has a keyway to fit the cutter. We also have a number of threaded collars which fit the small threaded stud on the end of the arbor. Each collar has 4 dowels spaced 90° apart, at equal distances from the center.

On each collar, the dowels are a different distance from the center, to adapt to cutters of different diameters.

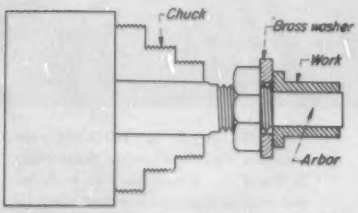
To make a cutter, a circular blank is turned to size, and bored and grooved for a keyway. A flat form tool of the corrected contour is made and hardened. This tool is used in a lathe, and we like to use a spring toolholder with the tool.

The cutter blank is keyed to the arbor and locked in place with the nut. Then the collar is threaded on securely. The arbor is chucked in an independent-jaw chuck, and adjusted until one of the pins runs true. The form tool is fed in until about 100° of arc have been cut.

Then the spindle is turned until the formed part of the tool is on top. A height gage reading is taken, to one of the steps of the tool. Next, the arbor is shifted in the chuck until a second dowel pin runs true. Check with the height gage until this section gives the same reading as the first part. Repeat for the two remaining sections.

Cutting edges are produced by milling slots, as shown. The slots should be milled with an offset inside the radial line, to produce top rake.

When making this tool, certain corrections must be made, to produce the desired form on the work. The *American Machinist Handbook* tells the method for figuring corrected forms. *Henry George, Bronx, NY*



Threaded Arbor Unsticks Work

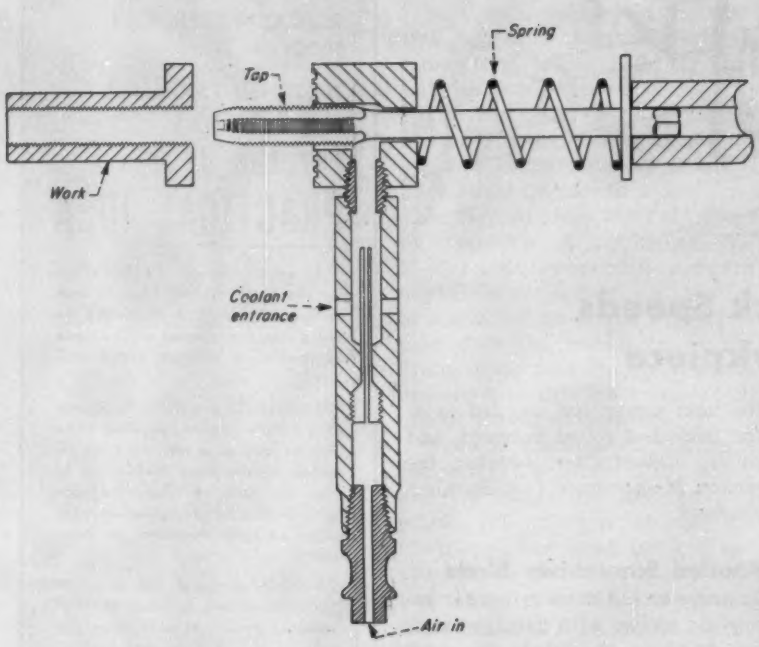
When thin-walled work, such as a bushing, is held on a slightly tapered arbor for finishing the OD, the work occasionally gets stuck on the arbor and a wheel puller or similar device has to be used to pull the work off. This is slow and may also damage the work.

To get around this trouble, we make a short threaded section on the arbor at the end of the work location. A large nut is threaded on this section, a brass washer is inserted over the thread, and the work can be put on the arbor and finished.

The brass washer prevents scoring the work when it is being removed from the arbor.

To remove the work, simply turn the nut down the thread and force the work off the arbor. *Carl Hoff, Roselle, N J*

"Snorkel" Cools Deep Tapping Job



We had a tapped-hole job that was so deep that even spiral taps were binding near the end of the thread. To do the job, we made the "snorkel" setup shown here.

In operation, the lathe coolant pours over the barrel of the air input, which remains stationary during tapping and backing out. An air line connected to the barrel supplies compressed air through a venturi tube, drawing coolant into the barrel through holes in its surface.

The air-coolant mixture passes through a hub which contacts the work shortly after the beginning of the tapping stroke, and prevents the coolant from coming out around the edge of the work. A spring holds the hub against the work.

When the tap is cutting, chips are forced out through the lathe spindle.

The small screw in the tube was taken from an engine carburetor. The tap for this job was a long starting-nut tap, held in a conventional releasing holder. *Robert Bryant, Kansas City, Kan*

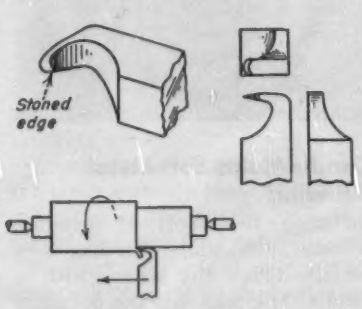
Slicing Knives Help Cut Soft Rubber Roll

We often machine soft and semi-hard rubber-coated rolls for textile machinery. The semi-hard rolls can be cut with carbide tools, with the edge ground as for wood —small wedge rake and large top rake.

However, the soft rubber cannot be turned that way, and we used to have to grind this work. If a lot of stock has to be removed, this takes quite a bit of time. Instead of this, we now have developed a good knife-like cutter, of HSS, which does this work.

The sharp edge of the cutter is stoned. This cutter works very well, leaving only a little stock for finish-grinding. Cutting speed is about 100 fpm, with 0.05 ipr feed, 0.100 in. depth of cut.

The cutter is designed like this:



Machining was done dry, and the chip came off as a strip about ½ in. wide. Tool life was about 1 hour, after which the edge had to be lightly stoned.

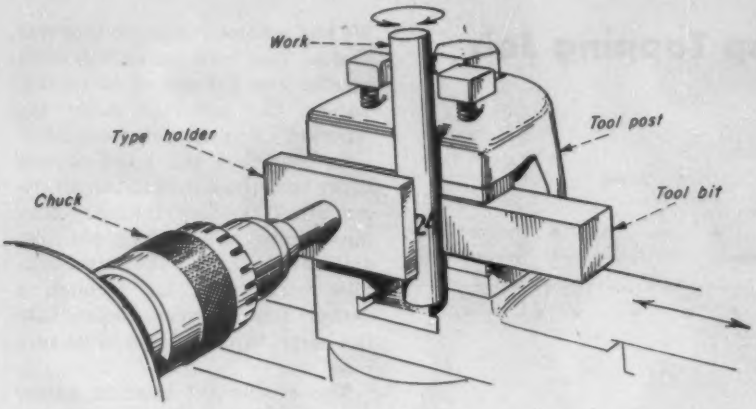
After experimenting, we developed a similar tool for boring this kind of work.

Cutoff was also done with this kind of tool, and even, for thin work, with mounted safety razor blades. *M Barash, Haifa, Israel*

Tray On Vise Saves Wear On Slide

A small metal tray fastened to the body of a toolmakers' vise and extending out over the back of the vise will help keep the vise in better condition.

The tray prevents workers from using the slide as an anvil, which marks the slide and eventually makes the vise hard to open and close. *Fred Lettino, Astoria, LI, NY*



Type-Holder In Chuck Speeds Marking Round Workpiece

We had to stamp a patent number on a ¼-in. diameter round workpiece, at a rate of about 350 pieces per hour. Instead of buying special equipment for this job, we built the simple setup shown here.

The marking type was set up in a standard type holder, the shank of which was then gripped in the chuck of a small engine lathe. The chuck was then locked so the type was held horizontal.

A toolbit was placed in the toolpost of the lathe, and locked in position. The work was then placed between the toolbit and the type holder, and the crossfeed was advanced. As the toolbit moved inward, the work was rolled across the type face, completing the job in a very short time. Instead of backing the crossfeed out to start again, the next workpiece was fed in at the back and rolled outward, and so on. *Robert Carr, director, Injection Maintenance Ltd, Burnley, England*

Knurled Screwdriver Blade

Improve an old screwdriver for removing screws with damaged slots by grinding the blade-tip sides parallel for 3/16 in. or so. Then knurl these faces and reharden them. *J Zilch, New York, NY*

Candle Helps Soft-Metal Grinding

To keep the pores of grinding wheels open while grinding soft metals, touch the wheel with a candle. The wax fills the openings of the wheel, and makes dressing the wheel for the next job much easier. *Hugh Lineback, Stillwater, Oklahoma*

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Drum-Lifting Tongs Handle Pots of Hot Parts

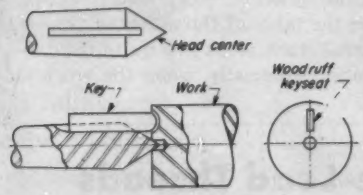
Drum lifting tongs capable of automatically clamping or releasing have been developed in the Central Shops at Argonne National Laboratory, Lemont, Ill., for handling radioactive parts.

The tongs are operated from a bridge type crane, and the clamping and unclamping are actuated by vertical movement alone.

As shown, tongs are held apart by a crossbar. A slot in each end of the crossbar permits outward motion as the bottom pad, curved to match the drum and beveled to pass over the rolled lip of the drum, drops past the lip. Hoisting upward then lifts the drum, which can be moved as desired.

When it is desired to disengage the tongs, the drum is set down, and the tongs are lowered still more. The crossbar strikes the drum top after being lowered approximately six inches and as the tongs are lowered a little more, they are spread outward by means of pins in angular slots in the crossbar. The pins finally lodge in a short vertical leg of the slots and thereby hold the tongs open. The tongs are then hoisted clear of the drum until the crossbar assembly contacts four nuts on top of studs fitted into a steel disc. The weight of the disc pulls down on the crossbar permitting the tongs to close to the position for reseating on the next drum. The steel disc referred to above also fits in the drum head recess, thus locating the tongs relative to the drum.

Tongs of this type are used to move drums containing highly radioactive fission products encased in concrete. For safety, the crane operator is normally located at least sixty feet from the material being handled. *Alexander A Denst, foreman, Central Shops, Argonne National Laboratory, Lemont, Ill*



Work-Driving Without a Dog

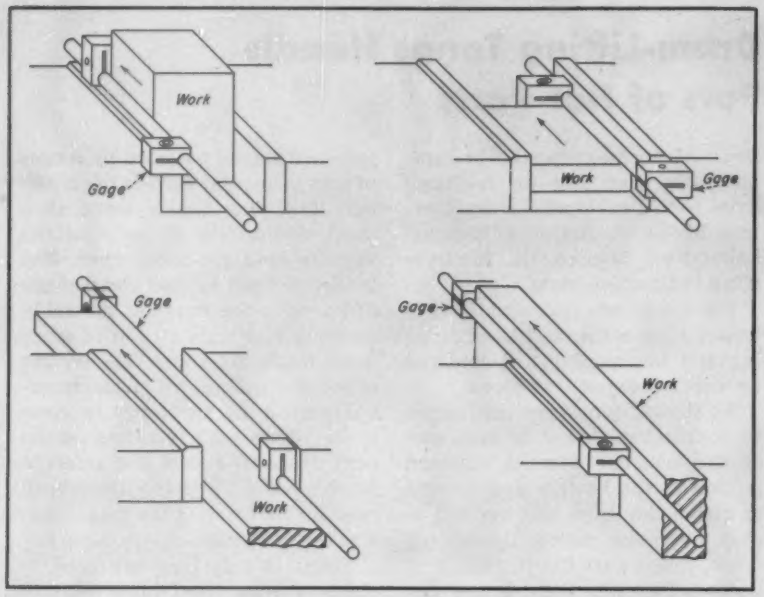
In certain cases it is helpful to be able to drive work in a grinding machine without the use of a driving dog, especially on short work, or on some plunge-cut jobs where the dog would interfere with the grinding wheel.

In these cases it is helpful to use the method shown here. The slot is ground or milled into the head center of the grinding machine. A "Woodruff" key seat is then milled into the end of the work, to receive the end of a key which is pressed into the slot in the head center.

The key should be slightly thinner than the width of the key seat, and the end of the key should be radiused off to a smaller radius than that of the key seat. This is necessary because the work must be a free-floating fit on the driving key.

Of course this method would not work where the key seat would not be suitable at the end of the work.

It may be helpful also to hold the key in the head center using a hose-clamp or similar strapping device. *H J Gerber, Stillwater, Oklahoma*



Simple Device Gages Vise-Held Work

Sometimes it is necessary to use a stop for locating work between jaws of a vise, such as when cutting off uniform pieces of a long bar, or when work is to be taken out of the vise and, at a later time, put back in.

Most commercial vises do not have any kind of work-locating stop on them. In this case, the usual practice is to clamp a stop on the table of the machine. Sometimes such stops are quite complicated, especially when the work is too small, lying completely between the jaws, or when the work extends beyond both ends of the machine table. Also, in cutting off operations, the stationary stop can cause trouble (broken blade or saw, distorted work, or dislocated stop) when the severed piece is "twisted" out of the vise between the stop and the remaining stock.

To overcome these difficulties, we have made a small portable work-locating gage which is suitable for any kind of vise, and handles wide ranges of work-sizes.

The gage consists of a rod, on which are mounted two rectangular members which can slide along the rod. The blocks are slotted, and are held in place with a setscrew. Note that one side of each of the blocks is flush with the rod, so the gage can be located in the "pocket" built by the work and vise jaw. In this way the gage is kept parallel to the jaw and work.

In some cases, not shown, both flat surfaces are needed, one lying against the work, and the other against the jaw.

When clamping the work, force is exerted as shown by arrows in the drawing, with the work being pushed against one rectangular gage block, while the other gage-end is located by the vise jaw. *Jaan Wain, Toronto, Canada*

Formula For Multiple-Lead Threads Speeds Shop Calculating

Multiple-lead threads, National form or Acme, can be rapidly and accurately indexed with this simple formula:

pitch x cot of thread angle.

For American National threads, set the compound rest at 30° and cut the first thread to proper depth. Then return crossfeed and compound to the original zero setting. With the formula given, we arrive at a new crossfeed setting.

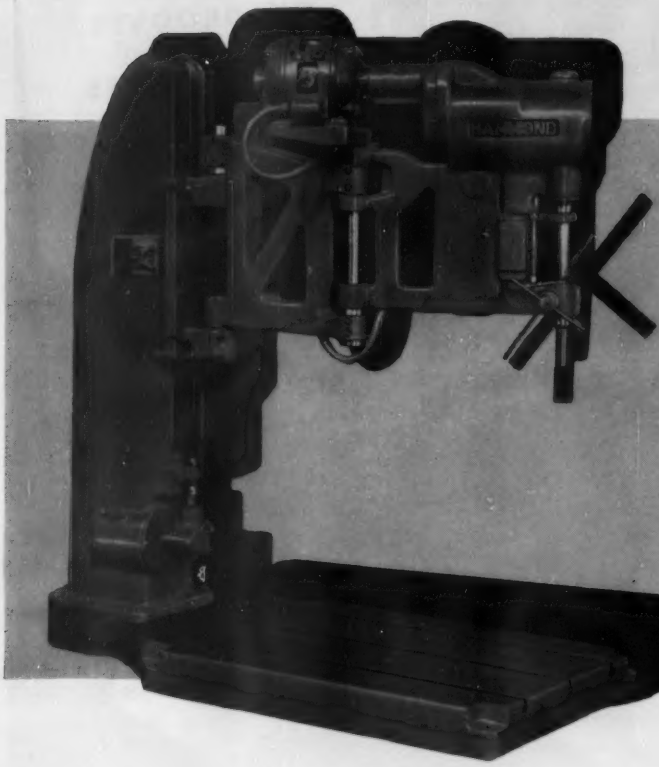
For example, if the thread is 16 tpi, quadruple lead, pitch is 1/N or 0.0625. Cotangent of 30 is 1.732. With the formula, 0.0625 × 1.732 = 0.108. Dial the crossfeed 0.108 in. from the original setting, start the machine, and engage half-nut for a trial cut. Dial the compound rest in until the tool touches the work. Reset the dial to zero. Cut the second thread to depth, and repeat as before until all four threads have been cut.

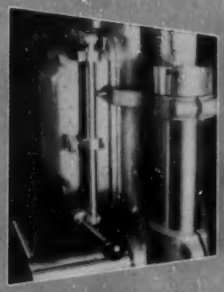
For Acme threads, use cot 14½° × pitch, and index in the same way.

For internal threads, the indexing procedure is reversed. Dial the crossfeed in toward the work, and back compound out until the tool touches. The formula remains the same. On lathes with direct-reading crossfeed dials, double the products obtained from the formula and index in the same manner. *H W Holmdahl, Honolulu T H*

FOOTBURT

for faster radial drilling and tapping





Hammond Radial Drilling and Tapping Machines may be spotted in the production line for drilling, tapping or reaming. With its unique Bracket Type construction the spindle can be swung quickly from hole to hole. Six Quick Speed Changes are instantly available and the Hammond Tapping Reverse is very fast and convenient to operate.

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Cleveland 8, Ohio

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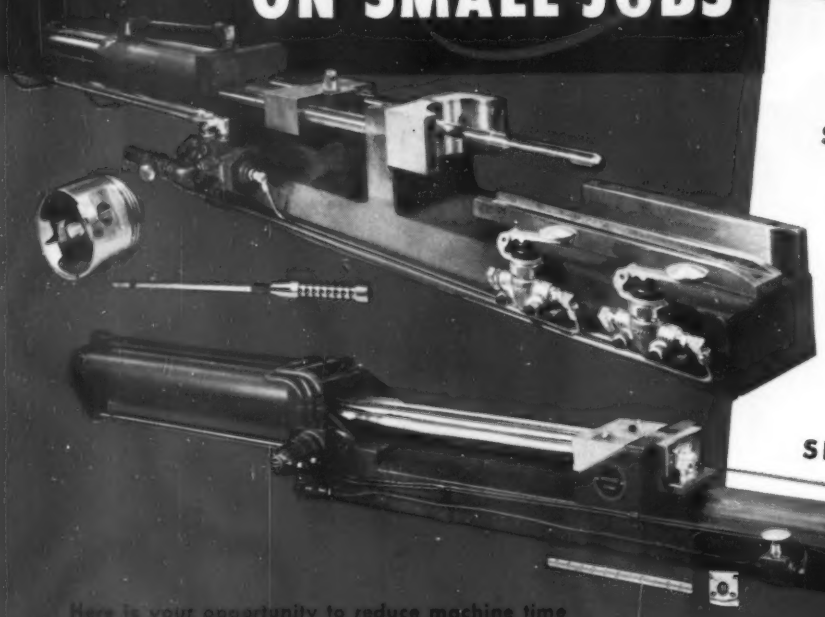
FOOTBURT

MACHINE TOOLS

Reduce Broaching Costs
ON SMALL JOBS



OIL GROOVES
•
SMALL SPLINES
•
SERRATIONS
•
KEYWAYS
•
SLOTTING
•
BURRING
•
SIZING HOLES

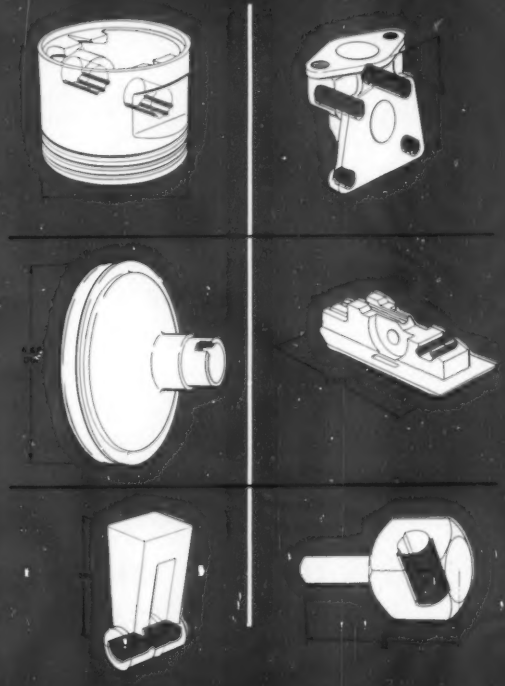
Here is your opportunity to reduce machine time and cut production costs on those small broaching jobs. And you avoid tying up your regular broaching machines which are built for heavier work.

The Red Ring Self-contained Broaching Fixture is a compact, portable, bench-type unit. Specifically designed for a particular job, it has all the elements (automatic and manual) of any well designed fixture. A pneumatic cylinder is added to pull or push the broach. Just connect it with the air supply and you are ready to start broaching.

These Red Ring Fixtures are used on a wide range of small jobs requiring a "Pull" not to exceed 2000 lbs. and a stroke of 25" or less. Here they are highly effective and very economical.

Investigate—talk with a Red Ring Engineer or write for Bulletin 854-9.

6978



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American Machinist REFERENCE BOOK SHEET

How to choose power brushes... I

R O PETERSON, mgr. technical dep't, THE OSBORN MFG CO, CLEVELAND, O

Power brushing cleans up surfaces, removes sharp edges, and reduces stress concentrations on machine parts by removing scratches, tiny cracks, and tool marks.

Lately many new applications and brush constructions have been developed, particularly for precision machining. And though the machines used for power brushing include portable and flexible-shaft equipment and brushing lathes, there are numerous standard and special automatic brushing machines that handle the parts as well as operate the brushes.

Generally a brush for a specific application is picked on the basis of what machines are suitable, available, or justifiable, and:

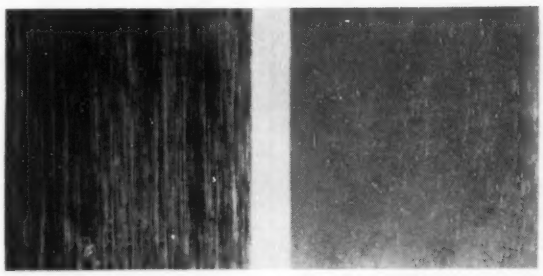
- Type of work
  - Original and desired surface conditions
  - Material to be removed—quantity and condition
  - Blending and rounding necessary
- Properties of the work material, especially hardness
- Speed and other work conditions

From these data, the amount of brush flexibility necessary, the strength of brushing action required, and the brush finishing capacity can be concluded.

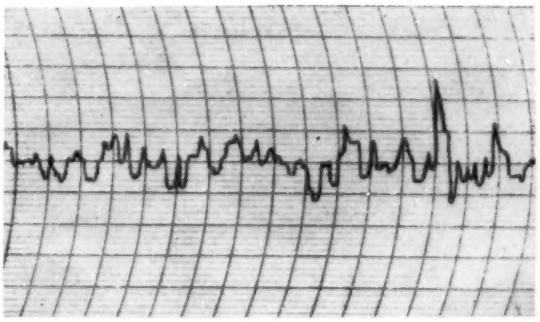
Commonly, one brush is used for a number of different jobs, but best practice is to pick the brush for each operation separately. Brush specifications include:

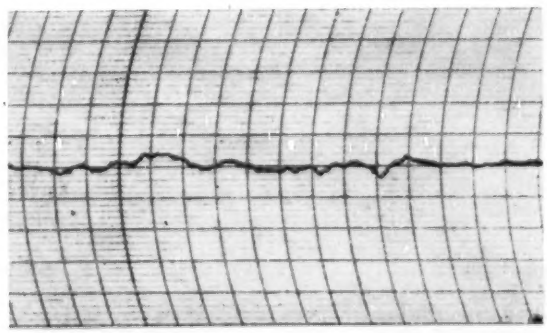
1 Fill material (wire, nylon, fiber, cloth, etc)
2 Size of fill (dia of each strand)
3 Trim length (beyond faceplates or back)
4 Density
5 Quality of fill (and special treatment, like crimps in wire)
6 OD of brush
7 Surface speed of brush

Wide variations in finish produced can be obtained by changing brush specifications. It is possible, for example, to meet surface-finish requirements on surfaces adjacent to edges that must be deburred and rounded. A flexible brushing wheel will follow irregular surfaces, providing the required surface finish without removing appreciable amounts of metal.



PHOTOMICROGRAPHS show relative surface smoothness before and after brushing with three different wheels

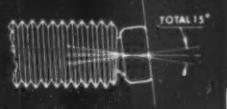




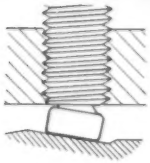
TOP MICROINCH CHART shows surface after being ground with 120-grit wheel. Bottom is same surface after brushing

Here's the secret to positive clamping... freedom from marring!

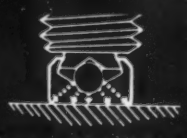
the New Vlier SCREW-BALL CLAMPS!



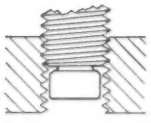
Ball-bearing construction insures frictionless, *automatic* angle adjustment and rotation; pad swivels freely in *all* directions up to 7½° from the centerline!



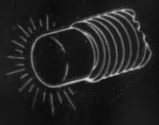
Pad seats firmly on work surface within angular range!



Force distributed equally to pad face. Conical seat distributes force equally in all directions; insures easy alignment in angular applications; greater freedom of motion.



Pad inserts from top of threaded hole or from bottom for easy installation!



Large pad area. Pad is machined from the solid, not counterbored or relieved; has greater strength plus freedom from distortion!

NO MORE EXPENSIVE, CUSTOM-MADE SWIVEL PADS... 17 size variations; ¼" O.D. up. N.C. threads; class 2 fit.

LOW COST...Saves hundreds of dollars annually in toolmaker's time!

NO MARRING...Rotation of pad ceases at first touch against the work! Soft seat saves surfaces!

HEX SOCKET HEAD...for easy hex key adjustments!

BLACK AS THE ACE OF SPADES! Completely rust proofed end to end!

KEEP VLIER SCREW-BALLS IN STOCK FOR INSTANT USE—SAVE YOUR TOOLMAKER'S TIME!

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VLIER ENGINEERING INCORPORATED

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TORQUE THUMB SCREWS— Apply accurate, controlled end pressures; eliminate distortion to the workpiece. 4 models; 19 sizes!

VLIER SPRING PLUNGERS— For use wherever accurate, positive spring loads are needed! 4 models; 40 sizes!

VLIER SPRING STOPS— Provide end pressures in fixtures when wall sections are not available. Two models: 14 and 32 lbs. end pressure.

VLIER TOGGLE PADS— Assure solid clamping of parts with uneven or off-angle surfaces. 5 sizes; fit almost any clamp.

VLIER FIXTURE KEYS— New 5-Way Key fits every standard mill table slot. 3-Way model also available.

Write for your complete catalog of Vlier products today! It's free!

How to choose power brushes... II

Brushes Vary with Work

Brush fill and construction are important to performance. These are some of the various kinds of fills now available:

Cord or fabric—fast cutting, medium flexibility, can finish to below 10 mu in. rms, use with compounds.

Tampico and treated fibers—flexibility, fast cutting, can produce finishes to 8-10 mu in. rms, use with tacky compounds.

Fine wire—wire dia 0.008 in. or smaller, used with compounds for deburring.

Wire sections—narrow face, medium density, good flexibility to follow contours.

Coiled-tuft sections—narrow face, low density, high flexibility, for high surface impact to remove surface encrustations.

Construction affects costs sharply, and also must be watched to prevent streaking the work or wearing too fast. Three general types are available:

1 Sectional—usually made in units about ½ in. wide and ganged to the width required—up to 6 in.

2 Helical—with open or closed faces, depending on helix pitch, which can vary from ⅜ in. to 2-3 ft.

3 Combinations—of first two types, plus end brushes, sibots, etc.

Brushes must be ventilated, must be strong, and must be flexible, to a degree depending on what kind of work is to be handled.

If the brush face must be 3 in. or wider, ventilation is necessary, and especially if the fill is wire. A top working brush temperature of 130F is recommended; otherwise short life may result.

Flexibility allows brushing rough contours, providing radii and fillets, and getting into recesses. This depends on fill material, size, length, and density—and on wheel speed, too.

Brush strength is essential, because under some conditions the major force is centrifugal force, and drag of the work is almost incidental.

Applying Brushes

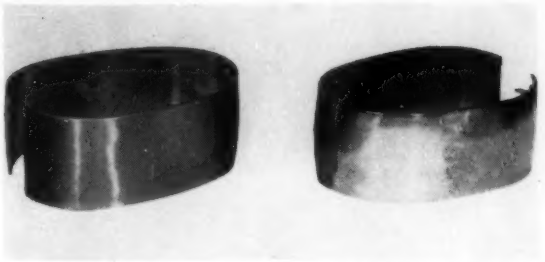
Plating work is commonly brushed with fiber fill, which has fast cutting action and smoothes the surfaces uniformly. Sharp edges or grooves that would build up current densities are eliminated.

Hard-cord brushes are applied to stainless steel because they have little tendency to develop drag lines—they are fast-cutting and have firm cushioning. Use of compounds increases productivity. Cord brushes produce high surface finishes on all metals, including hardened alloy steels.

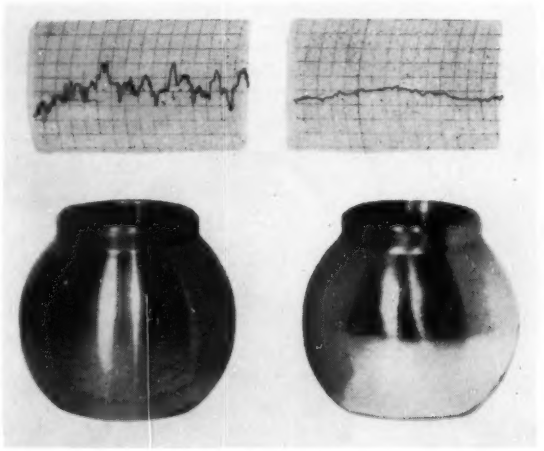
Power brushing to remove burrs has increased of late, partly because it does not tend to produce a secondary burr on the work. Automatic power brushes are considered essential in many plants for deburring, and have been designed to work at the rate of 1000 to 2000 pc per hr.

Power brushing operates smoothly with automatic equipment. An auto plant has one worker operating two gear-hobbing machines and a power brush that deburrs and blends the gears.

Brushes are expendable and are relatively inexpensive, so finishing costs can be as low as 0.001¢ per pc. Where costs seem high, a check on procedure may show that brush construction, size, fill material, or the setup should be respecified to gain better results.



FINE DETAILS, like design on toaster shell, are not blurred by tampico brushing, even though brushing has been firm enough to smooth out surface imperfections on curved surfaces

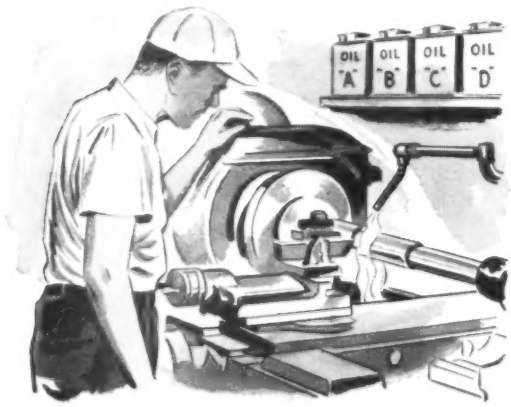


BEARING SURFACES, before and after brushing, were checked with surface analizer, producing the two charts as shown

How to Pick the Right Cutting Oil

WORD OF MOUTH?
It gives you the answer sometimes, but not many of your friends have the same cutting oil requirements and the same problems that you have. It's much surer to depend on specialists like Sun.

LABORATORY ANALYSIS?
Sure. But there's no formula for correlating the laboratory analysis with how well the cutting oil will work on your job. It takes years of field experience like Sun's to help you make the right choice.



ELABORATE SHOP TEST?
This will probably give you the answer. But it's expensive and interferes with production when you try to test all the oils available. Sun's experience can help keep your shop-testing to a minimum.

EXPERIENCE IS THE ANSWER.
And Sun has it. Its field representatives have probably come across problems similar to yours many times. If they haven't, its cutting oil specialists and metallurgical technicians are ready to help with your problem.

Soluble or straight, transparent or black, light or heavy duty—Sun makes the kind of cutting oil you need to handle your job at the lowest cost. For more information, call your nearest Sun office or write SUN OIL COMPANY, Philadelphia 3, Pa., Dept. AM-10.

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY

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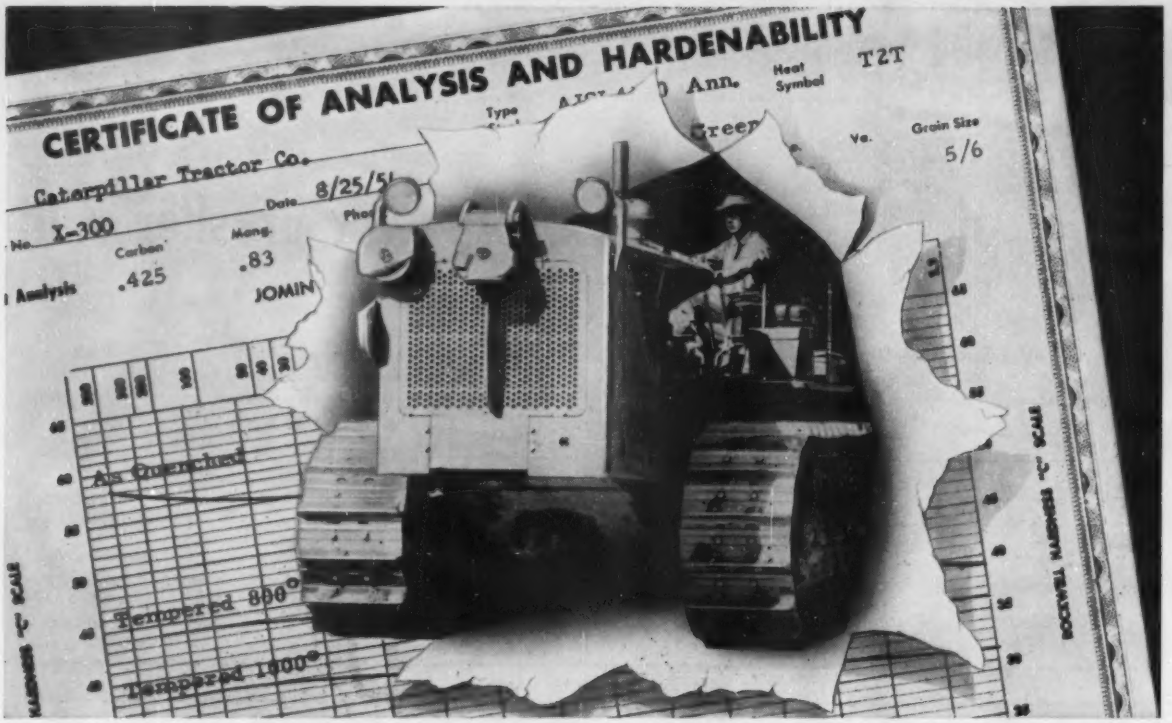
Refiners of famous High-Test Blue Sunoco Gasoline

American Machinist REFERENCE BOOK SHEET

How to choose power brushes... III

For Jobs Requiring Surface Finish Less Than 30 Microinches rms			For Jobs Which Permit or Require Surface Finish Exceeding 30 Microinches rms*		
Brush Flexibility: Medium ← → High			Brush Flexibility: Low ← → High		
Brush Finishing Ability: Very Fine ← (Low rms) → Medium			Brush Finishing Ability: Fine ← → Coarse		
Brushing Action: Medium ← → Very fast			Brushing Action: Medium Fast ← → Fast		
Cord & Fabric Brushes	Tampico & Treated Tampico Brushes	Fine Wire Sections Used With Burring Compound	Wire Wheels	Wire Sections	Coiled-Knot Sections
Major Brush Characteristics					
Fast-cutting medium–flexible wheels. Used with cut and color buffing compounds for producing low-microinch finishes.	Flexible, fast-cutting wheels. Used with burring compounds of tacky composition for producing surface finishes of approx. 8 to 10 microinches, rms	For efficient use of wire brushes with compound, select brushes having medium or high density and fine wire size (0.008 diam or finer)	Wide face, dense fill. Used where fast cutting and fine finishes are required Best general–purpose wire brush.	Narrow face, medium density. Used where medium brush flexibility is essential to follow contoured surfaces.	Narrow face, low density. Used where a high degree of brush flexibility is needed and where surface–impact action is necessary, especially to remove encrustations.
Major Applications in Order of General Usage					
1. Cut and color buffing 2. Surface blending 3. Light scale removal 4. Producing radii 5. Burr removal	1. Burr (small) removal 2. Producing radii 3. Light scale removal 4. Surface blending 5. Cleaning 6. Satin finishing	1. Burr (medium) removal 2. Light scale removal 3. Satin finishing 4. Producing radii	1. Burr (heavy) removal 2. Producing radii 3. Rust and oxide removal 4. Scale removal 5. Cleaning 6. Surface blending	1. Cleaning 2. Medium scale removal 3. Rust and oxide removal 4. Satin finishing 5. Surface blending 6. Burr removal	1. Heavy scale removal 2. Rust and oxide removal 3. Satin finishing 4. Producing radii 5. Burr removal (on vey hard metals)
Adjustments For Desired Results					
Brush works too slowly	Brush works too fast	Action of brush peens burr to adjacent surface	Finer or smoother finish required	Finish too smooth and lustrous	Brushing action not sufficiently uniform
1. Increase surface speed by increasing OD or rpm 2. Decrease trim length and increase fill density 3. Increase filament diam	1. Reduce surface speed by reducing rpm or OD 2. Reduce filament diam 3. Reduce fill density 4. Increase trim length	1. Decrease trim length and increase fill density 2. If wire brush tests indicate metal too ductile (burr is peened rather than removed), change to nonmetallic brush such as a treated Tampico used with Burring compound	1. Decrease trim length and increase fill density 2. Decrease wire diam 3. Try treated Tampico or cord brushes with suitable compounds at recommended speeds 4. Use auxiliary buffing compound with brush	1. Increase trim length 2. Reduce brush fill density 3. Reduce surface speed 4. Increase filament diam	1. Increase trim length and decrease fill density 2. Devise hand held or mechanical fixture or machine which will avoid irregular offhand manipulation

GENERAL RECOMMENDATIONS for various types of brushing fills. *For unusually ductile metals, see Adjustments, Column 3



Caterpillar® quality control inspires Ryerson certification

It was 1935—Caterpillar pioneering in quality control—was concerned about the uniform quality of alloy steels from warehouse stock.

Ryerson wished to serve its customers in the best possible manner. We sent our metallurgists to Caterpillar and asked them what could be done that wasn't being done.

Caterpillar pointed out that in the heat treatment of parts there can be as much difference in behavior between two mill heats of the *same* type composition as between two heats of *different* type composition. To emphasize this fact, they cited a statement in the AISI Manual that it would be false and misleading to assume all steels of a given composition are the same.

Ryerson accepted the challenge and began laying the groundwork for a quality control program which would include—1. selecting mill heats, 2. spark testing and carefully segregating every heat, 3. identifying each heat by heat symbol, 4. color marking for AISI number, 5. testing for hardenability in our own laboratory, 6. interpreting hardenability, 7. final inspection before shipment, 8. furnishing Certificate of analysis and guide to heat treatment.

After two years of preparation—we announced the Ryerson Certified Alloy Steel Plan in 1937. And now—not only Caterpillar but all other alloy steel users can buy high uniform quality alloys from Ryerson warehouse stocks with complete confidence. The plan takes time and money but has been helpful to Caterpillar—and we believe—even more helpful to companies without the elaborate testing facilities of Caterpillar Tractor Co.

It just happens that Ryerson is one of four companies that have been serving Caterpillar since their founding—so we are particularly happy to tell this story of progress in quality control—inspired by Caterpillar on this, their 50th anniversary of service to America and to the world.

Principal products: Bars, structurals, plates, sheets, tubing, alloys, stainless, reinforcing, machinery, & tools, etc.

RYERSON STEEL

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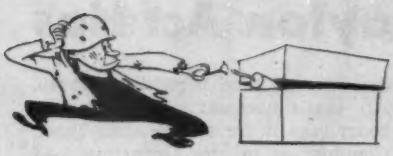
Talking Shop . . .



Blast It

MOORE Co, Marceline, Mo, had a tough problem of forming a Monel fan hub into a truncated sphere. It was a pretty tricky job until someone hit on this idea: Two sheets are welded into cylinders, one fitting closely into the other. The assembly is then dropped into a heavy, laminated die having the required spherical contour, and partly filled with water. A stick of dynamite is suspended inside at water level, a massive cover laid on top, and the dynamite exploded. Cover and water are tossed high into the air, but the Monel cylinders are forced into the die contour without cracking. The welds, too, are undamaged. Upper and lower halves of the die are separated to remove the work. Advantage of the process is that it wastes no metal, no trimming is needed, and no annealing. Wall thickness is uniform, and the cost is only 15% of that for spinning.

$1900 Can Opener

HANFORD Atomic Products Operation, Schenectady, NY, uses a $1900 can opener. After irradiation, "hot" materials must be removed from previously welded cans and transferred to shipping containers. The can opener is operated from behind 10 in. of shielding.

Point-of-view

PRESIDENT HOMER of Bethlehem Steel claimed recently that the invention of structural steel made possible construction of the Empire State building. "No, it didn't," said engineers, "Construction was possible with builtup sections — but that wouldn't be economically practical." Countered Mr Homer, "That's what I said: Structural steel made it possible."

Brain Waste

DR ELEROY L STROMBERG, formerly chairman, Psychology Dept, Western Reserve University, and now manager of training and personnel research for B F Goodrich, recently deplored the waste of brainpower represented by insistence upon college graduates in all "thinking" positions. He pointed out that this failure to train employes to reach the highest level of mental capacity, regardless of educational level, is causing an appalling waste. Creative thinking and problem solving need not be exclusive to the college graduate—some men and women without degrees can do much in this direction, and can thus have challenging jobs that lift them above the humdrum level of the automaton.

Coming and Going

THE WEARY German businessman no longer has the alibi that he couldn't get that report out in time, because he was on the train. Several long-distance trains in Germany now carry a train secretary who can take your dictation and type it out for you.

Tight Little Memory

THE CORE of any automatic control unit for a machine, a process, or an administrative operation is memory. A simple method of supplying memory to a control unit is from tape. A more advanced method is to have memory cells in the machine that can store information and provide it when needed. It is the need for memory cells that makes the giant computers so big.

Taking a preview look at the impressive new research laboratory International Business Machines has just built in Poughkeepsie, NY, we ran onto a development that may some day take the bulk out of memory units and permit compact automatic control.

IBM researchers have produced a single barium titanate crystal 3/16 in. square in which there are 256 memory cells. Across the top are 16 parallel gold lines, across the bottom are 16 more lines at right angles. The crystal can store one item of information magnetically at each of the 256 intersections. A machine can tap any one of them by connecting to the gold lines intersecting at that particular point. This tiny crystal can thus store more information than a 2-ft cathode-ray tube does in present electronic computers.

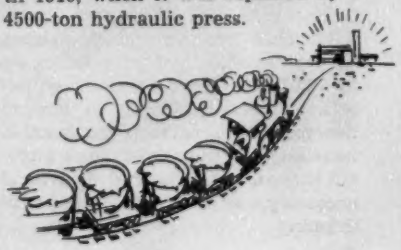
There was much talk at the time about the all-transister computer demonstrated in a laboratory model. It is a big step forward and no doubt they'll be commercially available in a year or two—but for the really startling, long-range developments in automatic control, keep an eye on that tiny crystal of barium titanate.

Chips Up

LANDIS MACHINE Co, Waynesboro, Penna, has a reinforced concrete chip bin with three compartments, for C I, steel, and alloy-steel chips. It is set up above gondola-car level, providing roofed storage underneath for other items and making it possible to empty a bin directly into a railroad gondola. Chips are brought up a ramp by fork trucks with tiltable containers—a method more than twice as fast as former barrowing.

Cast-in-Place

SAUGUS IRON WORKS restoration talk started us thinking that yesteryear's dreamers could do things in a big way too. For instance, in 1885, designs for the "giant" forging hammer at Terni, Italy, called for a solid 1000-ton anvil block. This colossal casting was executed on the spot, in position for operation. Petot, engineer, who directed the job, knew that cold cast iron would melt readily if immersed in molten iron, provided the ratio was correct. In the evening of Sept 13, mold preparation was complete. A few tons of molten iron were poured in, to dry and preheat it. Temporary cupola furnaces had been erected around the mold. At dawn on the fourteenth, pouring started and by eight o'clock that evening 283 tons of iron had been cast from the cupolas and 359 tons had been delivered by locomotive from a nearby foundry. On Sept 17, with the iron still completely liquid, casting was resumed and completed. After four days on the job, Petot slept. Six months elapsed before the mass was entirely cool. With the base a complete success, hammer construction was started, and the giant hammer was operated from 1887 until 1910, when it was replaced by a 4500-ton hydraulic press.



ANTI-MERGER LAW: Clayton Act Has

Those same teeth have been hidden up to now, what with the smaller automakers merging right and left in a last-ditch stand against the Big Three. But now the Justice Dept has uncovered a sharp clause in the Clayton Act that says you can't merge if the merger "may tend to substantially lessen competition"

WASHINGTON—Antitrusters here are shaping up a new hard line on mergers. Crucial test of this came in the recent Justice Dept turndown of the proposed merger of Bethlehem Steel Co and Youngstown Sheet & Tube Co.

Up to now, the impact of the anti-merger Clayton Act, passed in 1950, has not put a roadblock in the path of metalworking industry mergers. Earlier in the present administration, big mergers were approved, notably in the auto industry, where multi-million dollar corporations were allowed to combine because if they didn't there was a real threat that in a few years there mightn't be any more independents around to compete with the Big Three.

Attorney General Brownell's turndown of the Bethlehem-Youngstown merger thus dramatized a fact that up to now has only been sensed vaguely—that the loophole Congress closed in 1950 makes the Clayton Act the strongest antitrust weapon since the Sherman Act.

Here's why: the law bans any merger if it "may tend to substantially lessen competition." The merger need not produce a monopoly, or even tend toward monopoly. All that's necessary to make it a court case is for the Federal Trade Commission or the Department of Justice to contend that there is a reasonable probability that competition in general may be lessened. This is much easier to prove than that an actual monopoly exists or would follow on the heels of such a merger.

That is what Brownell was up against when Bethlehem and Youngstown, the second and sixth largest steel producers in the nation, respectively, proposed that they join forces. Bethlehem has assets of $1.78 billion and Youngstown has assets of $514 million.

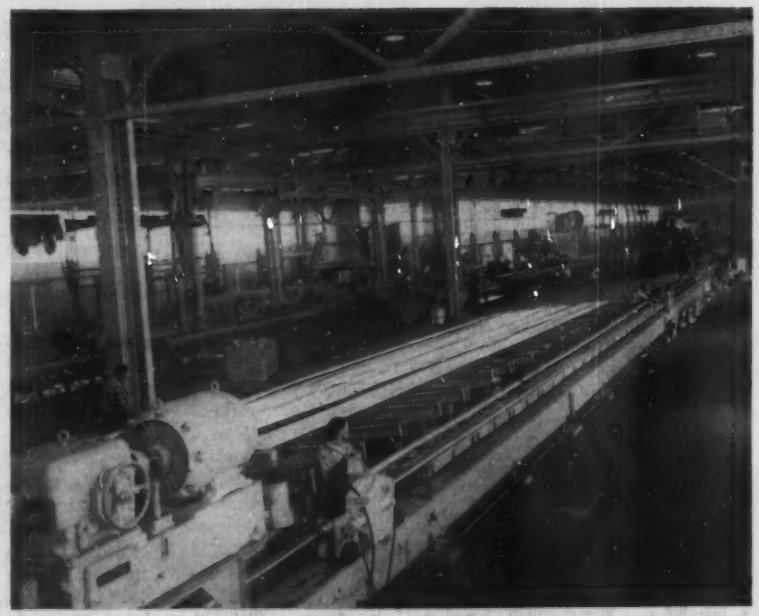
Brownell had no precedent to help in making a decision. It's not only that this case, like all mergers, is different from every other merger—if the Bethlehem-Youngstown merger were approved, companies in every industry could argue for mergers of their own.

Alcoa Installs Two 2500-Ton Extrusion

PART OF $6.7 MILLION EXPANSION PROGRAM

VANCOUVER, WASH—In what is claimed to be the Pacific Northwest's first major extrusion operation, Aluminum Co of America is in production on two 2500-ton hydraulic extrusion presses here as part of a $6.7-million fabricating expansion program. Also included in the expansion are three electrical conductor cable stranders, two wire-drawing machines, a complete ingot casting addition with four holding furnaces, and a pre-heat furnace.

After extrusion, shapes are cut to length on runout tables, then are heat-treated in a vertical furnace built over a 60-ft-deep quench tank. After heat treating and quenching, shapes are stretched with forces up to 75,000 lb. Then finishing equipment corrects angularity or bow in the extrusion, corrects contour if necessary—even untwists some angular shapes. Order is aged in oven if necessary, or is made ready for shipping.



One of Alcoa's two 2500-ton extrusion presses

READY TO RECEIVE HEATED ALUMINUM INGOT, press builds up pressure from five accumulator bottles, each weighing 30 tons and having a 900-gallon capacity

Teeth, Steel Firms Find

There's no doubt, judging from the history of the 1950 law, that Congress is erecting a big obstacle to stop the wave of postwar mergers. Brownell's ruling proves that Congress did its job well. Now the ruling seems to be that if there's any doubt about the merger at all, the antitrusters feel they have to turn it down. But it looks like Brownell's steel ruling will be taken to the courts for a showdown.

Key antitrusters say privately that they would welcome a test of the law in this particular case. They are convinced they would win hands down, and aside from this, they feel it's a good case to get a court interpretation on the meaning of the law.

Obviously, the case would take a couple of years to come to a final decision, whether it went to the Supreme Court or not. Meantime, there's a chance that Brownell may recommend changes in the 1950 law next year. In a recent speech, Brownell promised to recommend antitrust revisions now being fashioned by his Special Study Committee of lawyers and economists.

In the meantime, if you plan a merger and have doubts about antitrust clearance, it's best to clear it with either the FTC or the Justice Dept. But if you go to either and get a turndown, you won't get a chance with the other agency.

If you do get a refusal, and go ahead and merge anyway, you can almost be sure of a trip to court. FTC has filed cases against the companies that ignored its rulings, and the Justice Dept will do the same.

No one really can tell whether a merger is okay at present, but here are indications based on rulings to date:

You can merge if you're broke or losing business, or if you're diversifying, or if you're a "little fellow" in your industry, or if it's easy to enter your industry.

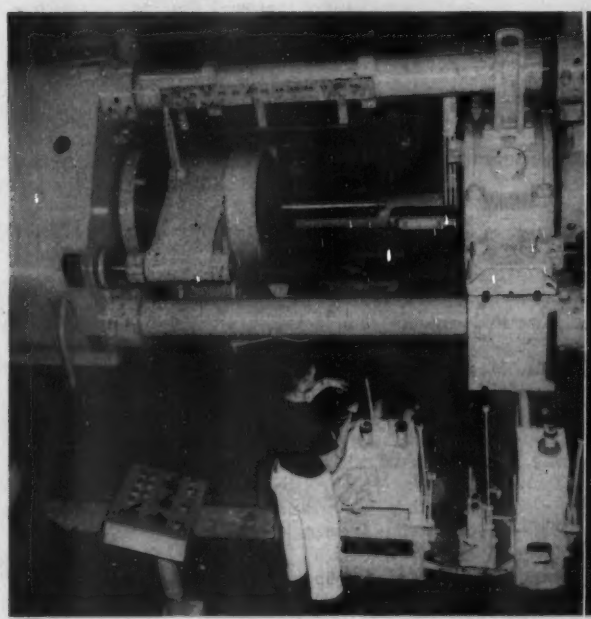
FORM NEW CARBIDE MANUFACTURING FIRM

McKEESPORT, PENNA — Newest firm to enter the cemented-carbides field is Firth-Loach Metals Inc, which went into production here October 6. Heading the new firm is L Gerald Firth, former head of Firth Sterling Inc, and one of the first US carbide patentors. William J. Loach, a pioneer in powder metallurgy and carbide development, will serve as the firm's vice president and general manager.

Modern Production Equipment

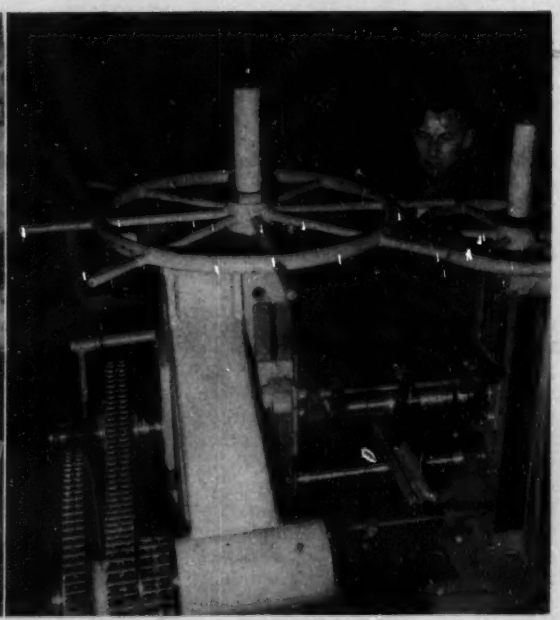
Firth-Loach is equipped to produce carbides by hydraulic, hydrostatic, mechanical or hot pressing. The plant features new ball milling processes that cut production time and at the same time ensure uniform product quality. Other plant equipment items include specially designed sintering furnaces, and such laboratory quality control equipment as a complete carbon analysis setup, x-ray and fluorescent inspection devices.

Presses at Its Vancouver, Wash., Plant



Stretcher

ENDS OF EXTRUDED SHAPES are grabbed by stretcher, which exerts 75,000-lb straightening force



Finishing

CONTOUR MACHINE, carefully controlled, finishes extruded shapes — the final step before shipping

A Casting a Second Heralds

Mold handling

MOLD CONVEYORS move copes and drags side by side, flip cope onto drag

Automatic shell-molder

AUTOMATIC SHELL MOLDING MACHINE can be switched from pattern to pattern in 30 seconds or less

Titanium to hold Spotlight at Metals

ASM will share its five-day National Metal Congress program with three other technical societies. Their common goal: new alloys to meet the changing needs of modern industry

CHICAGO—Titanium and other high-strength, high-temperature alloys to meet today's industrial demands will be the center of technological interest when the American Society for Metals and three other technical societies—American Welding Society, AIMME's Institute of Metals Division, and the Society for Non-Destructive Testing—hold concurrent technical programs at downtown Chicago hotels during the 36th Annual National Metal Congress & Exposition at the International Amphitheater November 1-5.

While the societies' programs are principally concerned with metals production, some of the papers and symposiums are of interest to metalworking men:

American Society for Metals program, to be held November 1 through 5 at the Palmer House, on Monday afternoon, November 1, will deal with metal processing. This session will include papers on "The Influence of Chemical Composition of the Machinability of Rephosphorized Open Hearth Screw Steel," and "The Influence of the Grinding Process on the Structure of Hardened Steel." Tuesday morning session will take up the hardenability of high-carbon alloy and tool steels. Thursday morning heat treating session will cover "The Role of Water Vapor and Ammonia in Case Hardening Atmospheres," and "Effect of Heat Treatment on Microstructures, Microconstituents and Hardness of a Wrought Cobalt-Base Alloy."

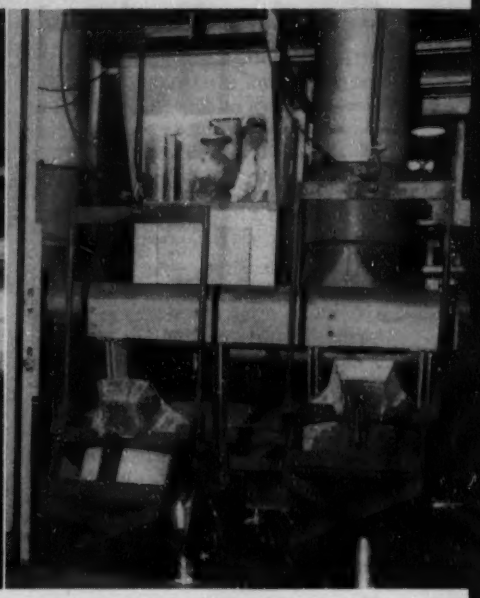
AIMME's Institute of Metals Division, meeting at the Morrison Hotel, will feature a Monday morning session on powder metallurgy, including a paper on "Warm Pressing of Beryllium Powder." On Tuesday, the Institute will hold its Third Annual Symposium on Titanium, which will include presentation of papers in the morning, and a panel discussion in the afternoon. Another titanium session will be held Wednesday afternoon, and will include papers on heat treatment and properties of Ti-Cu and Ti-C alloys.

American Welding Society's program at the Sherman Hotel will have a Monday morning session on flash-welding high-strength steels, and effect of post-treatment on flash welds. Tuesday morning sessions will cover spot welding aluminum with single

Age of the Pushbutton Foundry

Automatic pouring unit . . .

EBERHARD MFG CO'S ELABORATE POURING SETUP is capable of pouring four molds at a time in 16 seconds



is pushbutton controlled

POURING IS PUSHBUTTON-CONTROLLED from this glassed-in booth

Six Men Do 40 Men's Work at Eberhard Mfg's Automatic Foundry

CLEVELAND—One 2½-lb gray iron casting is coming off the line every second here at the world's first pushbutton foundry, built by Osborn Mfg Co of this city for Eberhard Mfg Co, a division of Eastern Malleable Iron Co. With the new $600,000 foundry production circuit system, six watchmen now replace 40 skilled and semiskilled workers. Labor savings are estimated at $300,000 a year.

The Osborn-designed automatic foundry production circuit system occupies only 7200 ft of floor space, is 68 ft high at its top. The machines and equipment needed for equivalent output by conventional methods would form a 450-ft line.

Here's how it works:

Cores are made on a multi-station rotary unit. Molding unit, made up of two parallel molding lines, is fed by the same sand handling system. Cope and drag flasks are filled alternately at the sand filling station. Pattern equipment, mounted on a turntable is indexed to the filling station in such a way as to match the cope or drag being fed in. Then the filled flask halves are indexed to the molding station, where they are jolted and squeezed. Flasks are then indexed to the draw station. Alternate cope and drag flasks now move along the conveyor line and are separated into two lines, with the drags traveling on a line 3½-ft lower than the cope line.

One Hand Operation: Cores

Cores are inserted manually, then the copes are mechanically flipped onto the drags to form the complete mold. Molds are then conveyed to the pouring station, where an overhead conveyor brings in the molten iron from the cupola, and pouring is controlled from an enclosed booth. Mold is cooled to 800 F and carried to an automatic shakeout.

Show

phase equipment, seam welding of low-carbon steel, automatic percussion welding, recent developments in contact electrodes, and electrodes with powdered metal coatings.

Tuesday afternoon will see discussion of arc welding of powder metals, weldability of high alloys, high-nickel overlays on ferrous metals, and the inert gas metal arc overlay process. Wednesday sessions will take up welding of zirconium, new developments in inert gas welding, silver brazing of refractory metals, filler-metal strengths in brazed copper joints, fundamentals of fused metallized coatings, and practical applications of both fused self-fluxing and non-self-fluxing metallized coatings. Thursday sessions will take in brazing of thin materials for jet engines, automatic welding of railroad cars, oxygen cutting with iron powder and chemical fluxes, sigma arc cutting, and oxy-fuel combustion. Friday will cover welding of 347 stainless.

Pressed Steel Car Co Buys Clearing Machine

CHICAGO—Pressed Steel Car Co has purchased the assets of Clearing Machine Corp of this city, makers of industrial presses, for approximately $9,850,000, it is announced by John I Snyder, Jr, president and board chairman of Pressed Steel Car Co.

Becomes Largest Division

With Clearing sales currently amounting to about $30 million a year, with after tax profits pegged at about $2 million annually, Clearing will become the largest of Pressed Steel's divisions.

According to Mr Snyder, "as a result of this acquisition, which is by far our largest to date, Pressed Steel Car can expect normal annual sales of around $90-100 million from now on . . . In addition, the purchase makes us a major factor in the US machine tool business."

Clearing Management Stays

Under terms of the purchase, Pressed Steel acquires Clearing's manufacturing plants in Chicago and Hamilton, Ohio. Present Clearing management will be retained.

COLLEGE-INDUSTRY LIAISON: U of Mich Leads the Way

ANN ARBOR, MICH—The College of Engineering, University of Michigan, has launched a broad program designed to open up more direct channels of communication between the College and industry in general. Called the Industrial Program, it provides industry subscribers (subscription fee, $5,000 a year; minimum subscription, three years) with regular information on the College's latest engineering and scientific accomplishments. The University of Michigan says the program is the first of its kind available to industry on a broad basis.

University officials estimate that between 10,000 and 13,000 pages of original research data are produced each year by members of its faculty and student body. Publication of much of this material, in technical journals, etc., frequently lags a year or more behind actual work. One important feature of the Industrial Program will be to distribute this information to subscribers as soon as possible.

Summaries of current research and development activities and copies of technical reports, bulletins, manuals, circulars and other pertinent data will be sent subscribers. Special meetings and annual symposia will bring industrial representatives to the College to discuss the latest activities and problems in their various fields.

A pamphlet describing the Industrial Program is currently being distributed, and two special bulletins are scheduled for distribution to subscribers later this fall. One is a comprehensive survey of all industrial activity in the nuclear engineering field; the other is a complete manual of welding techniques, materials and developments. Future reports, preprints and technical meetings will cover the fields of high-temperature metallurgy, combustion, computer design and application, fluid mechanics, electronic instrumentation, acoustical measurements, petroleum and hydro-carbons, others.

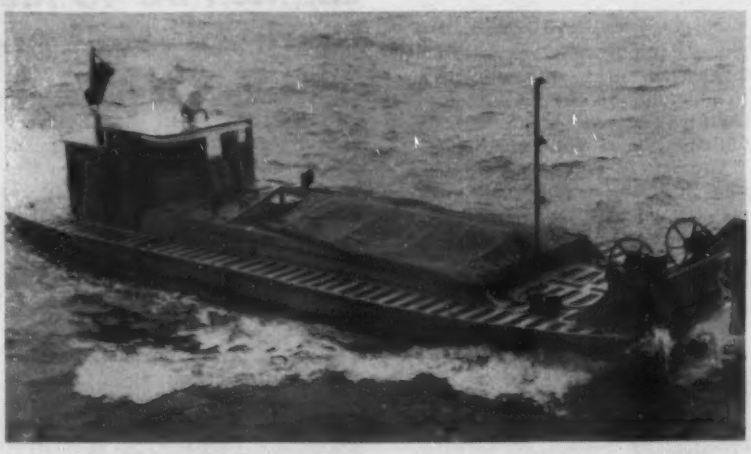
Further information about the Industrial Program can be obtained by writing Dean George C. Brown, College of Engineering, University of Michigan, Ann Arbor, Mich.

CIT Offers Tool Financing Plan

NEW YORK — CIT Corp has announced what it believes to be a completely new approach to the financing of machine tools, fork trucks and construction equipment. CIT's plan, geared to take advantage of the new fast depreciation, makes it possible for purchasers to pay for a machine at approximately the same rate at which it is depreciated, instead of in a series of equal installments.

Under the new plan, CIT has stretched out its terms to closely approximate the useful life of the machine: 10 years on machine tools, six years on gasoline lift trucks, eight years on electric lift trucks, and six years on construction equipment. Formerly, respective terms for these items were 5, 3, 3, and 3 years.

Normal down payments on machine tools and other equipment will still apply.



Plastic Barge

DESIGNED FOR USE IN SHALLOW INLAND WATERWAYS OVERSEAS, this plastic barge weighs only 10.2 tons, can transport 5 tons of dry cargo with a draft of only 21 in. when loaded. The 50-ft craft, designed by W R Chance & Associates in cooperation with the Army Transportation Corps, is powered by two 165-hp GM diesels. It breaks down into 15 sections for shipment by air, rail or truck, and can be assembled in the water without special skills or tools. Damage is easily repaired — in the same manner as plastic-bodied sports cars

Kaiser to Build 44,000 Cars A Year in Argentina

BUENOS AIRES—Henry J Kaiser has acquired a new partner in the automobile manufacturing business—the Argentine government. Kaiser has announced plans to build a plant in a suburb of Buenos Aires for manufacturing 40,000 cars, trucks and jeeps a year.

The Argentine government and private Argentine investors have an interest in the company, but Kaiser will manage it.

Willow Run Machinery

Machinery from Kaiser's Willow Run plant near Detroit, that became surplus when Kaiser merged with Willys last year and production was consolidated at one plant, will be moved to the Argentine Kaiser plant, and to similar facilities Kaiser plans to set up in other Latin American countries. According to a Kaiser spokesman at corporate headquarters in Oakland, Calif, Kaiser will install $10 million worth of machinery in the Argentine plant.

Construction of the Argentine plant is to be started immediately, and the plant is slated to be in production within a year.

Kaiser's partner in Argentina will be the state-run IAME plant, which will contribute 80 million pesos to formation of the new operation, with Kaiser putting up the remaining 140-million pesos. An additional 211.4-million pesos will be raised from private sources. Shares in the new corporation are to be offered on the Buenos Aires Stock Exchange by Argentina's Central Bank.

RUSSIAN AUTO OUTPUT INCREASING THIS YEAR

NEW YORK—Russia's Molotov automobile plant at Gorky is reported by *Pravda* as close to meeting its 1954 goal of manufacturing 28-30% more medium-priced Pobeda passenger cars, 83% more high-priced ZIM automobiles, and 14-15% more trucks than it did in 1953. Overall output at the Molotov plant is reported up 29% during the first five months of this year.

90% Belt Operation

Says *Pravda*, 90% of all assembly operations at the Molotov plant are now done on belt lines, and 10 automatic lines have been put into operation in machine shops. And, *Pravda* adds, Russian plants have "dozens" of overhead carriers, and "hundreds" of general-purpose machines have been replaced by multi-purpose equipment, or changed over to high-speed cutting.

EUROPE'S BIGGEST STEAM TURBINE

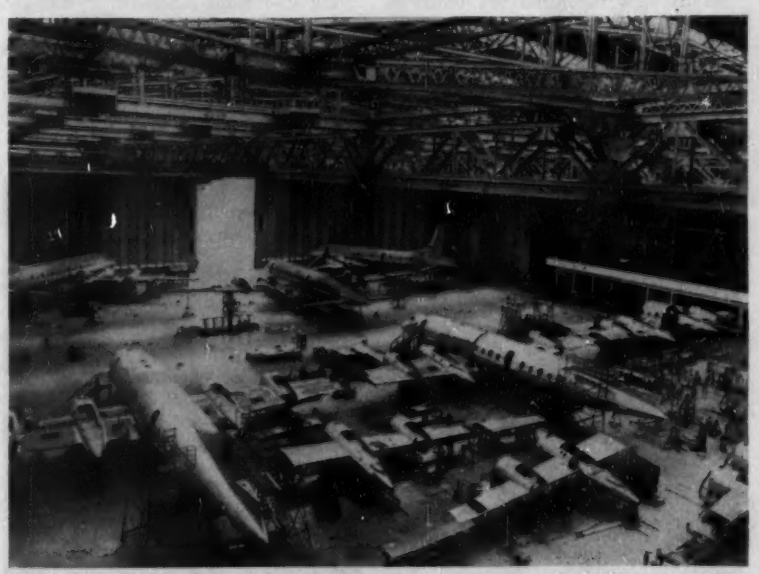
BONN—Largest counterpressure steam turbine ever built in Europe, after 20 months in the making, has passed final test runs at the MAN, Augsburg, West Germany, and will shortly be delivered to the new power plant Fortuna of the Rheinische Braunkohle AG, Cologne.

The turbine is capable of producing 52,000 kwh at 3000 rpm. It requires 500,000 kilos of steam at 500 F and a tension of 116 Atu per hour to keep it running.

AUSTRALIA's AUSTIN MOTORS TO EXPAND

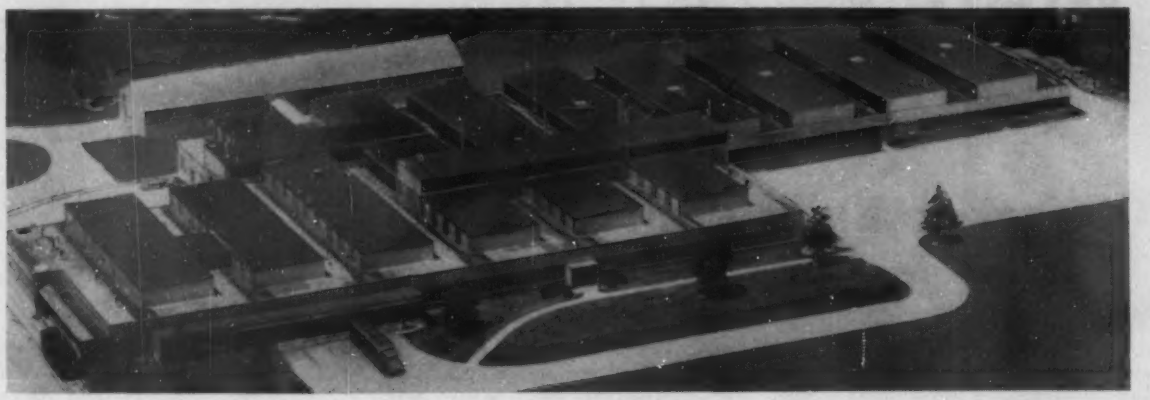
SYDNEY—Plans for a multi-million-dollar expansion program for Austin Motors of Australia have been announced by the British Motor Corp (Australia) Pty Ltd, parent company of Austin of Australia.

Plans include setting up of a modern assembly plant and extensions to Austin's Victoria Park factory in Sydney and its body-building and assembly plant at Fishermen's Bend in the state of Victoria.



Britain's Long-Range Turboprops

NOW IN PRODUCTION is the Vickers Britannia, a long-range turboprop airliner that carries 100 passengers. Here the first Britannias take shape in the assembly hall of Bristol Airplane Co at Filton, near Bristol, England. British Overseas Airways Corp has ordered 35 Britannias, which are made in two versions, each powered by Proteus turboprops and having fuselages between 114 and 124 ft long. Only jets are faster than the Britannia



AERIAL VIEW of Cincinnati Milling Machine Co's Products Division Plant

CINCINNATI MILLING: Young Ideas at

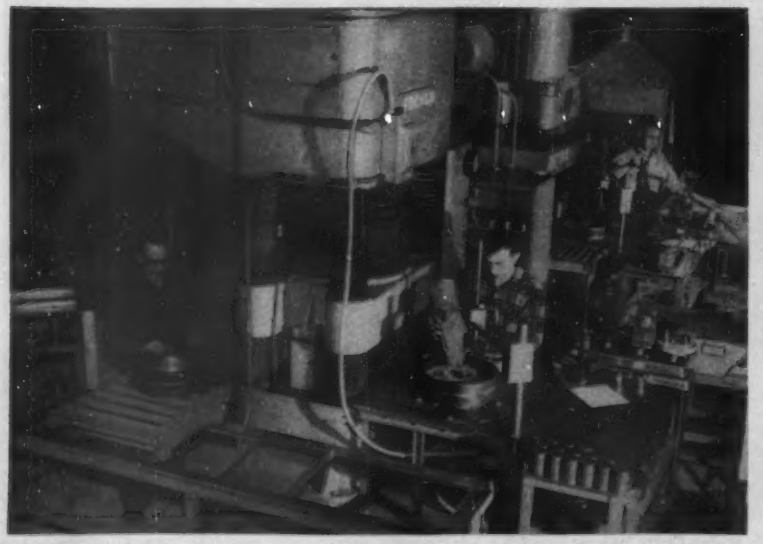
CINCINNATI — Cincinnati Milling Machine Co is celebrating its 70th anniversary by showing to customers, technical societies and industrial groups its new plants, new products and new ideas for lowering machine tool users' costs. The program began on October 7 with a press preview and will continue until late in the year.

Many new machines are featured in the display at the company's Cincinnati plants. A new HyPowermatic heavy-duty bed-type milling machine, embodying a number of important design improvements over current designs of bed-type machines, was unveiled at the preview. A new No. 1 cutter and tool grinder, a new small toolroom milling machine with swinging head and a vertical slotter head with 4-in. stroke on the rear end of the over-arm, an improved No. 2 centerless grinder, a new No. 0 centerless grinder, and a new reciprocating-table surface grinder were among the machines on display.

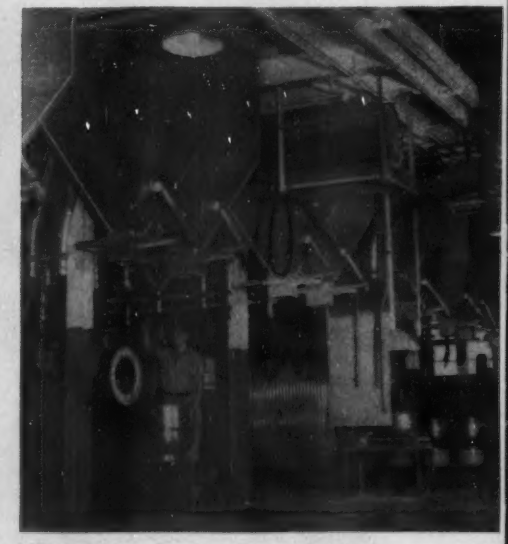
Visitors also saw two special "Hydrospin" power spinning machines capable of automatically spinning conical and cylindrical shapes cold from heavy steel disc blanks. These machines are equipped with opposed rollers working on opposite sides of the mandrel, instead of a single roller. The machines are prototypes of a line of new machines to be announced sometime in the future. In fact, detailed descriptions of all the new machines will not be made public until some future date.

Guided Plant Tour

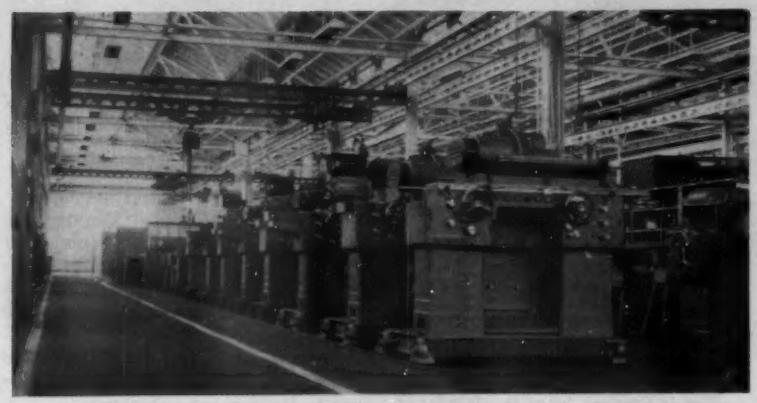
A trip through the engineering and headquarters building, main plant, heavy machining plant, foundry, Products Division and Process Machinery Division was a feature of



GRINDING WHEELS are turned out at Cincinnati Milling's Products Division plant on huge wheel presses like this one



BATTERY OF LOADING CHUTES loads grinding wheel materials



ASSEMBLY LINE for Cincinnati's center-type grinding machines

Three-Score-and-Ten

the day. A considerable part of the tour, measured in miles, was made in small motor-powered trains. A journey through the company's Technical Training Center was another highlight. It included shops, class room, interview rooms, auditorium and the Fred A Geier Memorial Room. The Training Center is completely new and provides a large increase in area for the 21 training courses now being given.

Original Shop Facsimile

Of uncommon interest was a reproduction of the company's original shop as it appeared in 1884, with Cincinnati machines built during that period. Two special presentations, including a new movie "William Johnson and the Dragging," were interspersed with the more technical events of the day. The movie is a new animated approach to the problem of machinery replacement.

Frederick V Geier, president of the Cincinnati Milling Machine Co, headed the hosts and addressed the preview visitors at luncheon.

Research Labs Shown

Visitors were also shown through Cincinnati Milling's Central Research Laboratories, devoted to developing fundamental information that can be applied to existing products and processes, or in creating new ones in such fields as basic metal cutting, grinding and forming; applied metal cutting and grinding; applied friction, lubrication and metal forming, dynamics and physical analysis, physics and metallurgy.

Frederick V Geier
President
Cincinnati Milling Machine Co

ASSEMBLY AREA for Cincinnati's horizontal broaching machines

$185 Million For GM Expansion In Europe

NEW YORK—Following in the wake of President Harlow H Curtice's tour of General Motors Corp's European plants, General Motors has announced it will spend some $185 millions in expanding its automotive facilities in England and on the Continent.

Lion's Share: Vauxhall

Lion's share of the expansion program will go to General Motors' Vauxhall Ltd of England, where some $103 million will be spent on plant and equipment—$50 million of this is said to be for new tooling alone.

Second largest expansion program will be for the GM-owned Adam Opel AG of West Germany, where upwards of $71 million will be expended on automotive production.

GM Suisse (Switzerland) SA will start work immediately on a $3.5-million expansion project, which will increase floor space at the Bienne plant by 200,000 sq ft, doubling its present output capacity. Suisse assembles and distributes Vauxhall, Opel and American GM cars and trucks.

General Motors will also spend $6 million in expanding its auto and truck output at General Motors Continental, Antwerp, Belgium. A large addition will be started immediately, increasing GM's investment in the Antwerp plant to upwards of $20 million.

Europe: War to Peace

Thinking behind General Motors' tremendous Continental and British expansion is that Europe is making a "remarkable transition" from a war to a peacetime economy, and that demand for commercial and pleasure vehicles will increase greatly in the near future.

This expansion program is expected to increase production at Vauxhall from about 160,000 vehicles a year to 250,000. The same figures hold true for Opel. Since GM Continental at Antwerp and GM Suisse at Bienne, Switzerland, are assembly plants, it is difficult to predict exactly how much assembly output will be increased in those two facilities, GM officials say, but the increase will be substantial.

Seneca Falls Broadens Into Electronics Field

SENECA FALLS, NY—In line with the current metalworking trend toward diversification of product, and with an eye to the increasing use of electronics in machine tools, Seneca Falls Machine Co of this city has formed an Electronics Division. The company has been experimenting with electronic applications in machine tools for some time.

The Reason Why

Thinking behind this move was expressed this way by Seneca Falls President Edwin R Smith, who said the time has arrived "when any machine tool builder who intends to be in a competitive position in the future should devote some of his time, energy and money to the development and application of electronics."

Many of today's machine tools, he added, are automatic in their functions and require little of the operator's time. "It would therefore seem that we have reached the ultimate. However, with the tremendous development that has been made in electronics, particularly with servomechanisms, we probably will see in the next few years new and better machine tools which will not only do the work required, but also the thinking. . . . It is difficult to tell at present just how far this trend is going, but it would seem that if we can produce at reasonable cost machines which further reduce physical and mental effort, they will be in demand."

Opens New Fields

And, Mr Smith added, while the company was originally interested in electronics only in connection with machine tools, it now appears that some of Seneca Falls' experimental devices may be applicable to other fields.

Eisengrein Heads Division

Heading the new Electronics Division is Robert H Eisengrein, who comes to Seneca Falls from Sundstrand Aviation, where as chief research engineer he headed analysis, development and design of automatic control systems and components. Mr. Eisengrein is the holder of four patents in the electronics field.

MILITARY PROCUREMENT: The Long Drought Is Over

In the last few weeks, the Air Force, Army and Navy have begun to pour out orders for military hard goods—ending a year-long "dry spell"

WASHINGTON—A stream of new orders is flowing from the Pentagon, and it will be kept flowing, with at least another $1-2 billion forthcoming in the next couple of months as the Pentagon cranks up into place a total of $16-18 billion worth of new contracts before next July 1. The Air Force, which has already placed contracts totaling more than $1.2 billion for nine different aircraft and five types of jet and turboprop engines, is expected to place a big chunk of its new contracts for engines on the next go-round.

$1.2 Billion Awarded

While dollar totals of Air Force contracts to date haven't been revealed, the major portion of the $1.2 billion goes to (1) Convair for B-58 bombers and C-131 twin-engine transports, and (2) to Lockheed for the lightweight F-104 fighter and C-130 turboprop.

Boeing, too, is getting more orders and is stepping up production of the B-52. North American is getting another round of orders for its F-100 fighter.

Deliveries of aircraft are expected to have shorter lead-times, so there will be no gap in phasing-in new aircraft as existing models are phased out.

Sikorsky at Bridgeport, Conn, has gotten additional airframe contracts for H-37 helicopters for the Army. Beech Aircraft has new orders for T-34 jet trainers.

$162 Million for Engines

Contracts totaling in excess of $162 millions have also been awarded to engine manufacturers. Pratt & Whitney Division of United Aircraft received a $50 million contract for production of the J-57 jet engine, and a second-source supplier—Ford Motor Co—will build an additional $22 million worth at its Chicago plant.

Allison Division of GM has a new $34-million contract to make J-71 jet engines and $35 million to make T-56 turboprops. General Electric has been given a $21-million contract to make J-73 jet engines. Pratt & Whitney also has a contract to make YJ-75's, a more-powerful version of the J-57.

Meanwhile, Army Ordnance has placed some $266 millions in contracts for combat vehicles:

- Chrysler gets $160 million to make the M-48 Patton tank, $42 millions for the M-51 tank recovery vehicle, $855,000 to tool and produce the Redstone guided missile.
- GM's Pontiac Division is in production on the new all-aluminum M-76 amphibious cargo carrier.
- Food Machinery & Chemical Corp has a $26.5-million contract to produce the M-59 personnel carrier.
- GM's Cadillac Division has a $35 million contract to make the M-42 twin-40mm gun unit mounted on a self-propelled light tank chassis.

Spending: $13.3 Billion a Year

The new contracts will help keep military spending (actual writing off of checks for work done, as opposed to contract awards) at around $13.3 billions for the year ending next June 30. About 60% of the total goes for new aircraft programs, with the balance split among such items as ordnance, ships, ammunition.

Missile Spending Increases

Guided missile spending, while still small in relation to other major hard goods procurement, is rising most sharply. Expenditures for missiles in the last two years totaled less than $300 millions. This fiscal year it will top $500 million. And, procurement officials say, it will reach the $1 billion mark within the next two years.

Ammunition procurement is dropping sharply, with expenditures expected to reach only $1.4 billions this fiscal year. This is less than half of last year's total.

Spending for Army combat vehicles will be an estimated $610 millions this year, but will drop off sharply by next July.

Shipbuilding will amount to $900 millions—less than fiscal 1953 and 1954—but it is expected to increase gradually.

Herbert S Ries

Edgar D Leon

A B Drastrup

Names in the News . . .

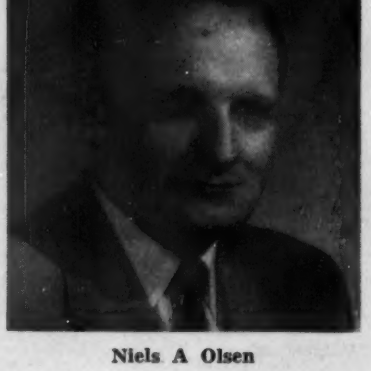
Herbert S Ries has been elected president of Gear Grinding Machine Co's recently-purchased subsidiary, Republic Gear Co, Detroit. Mr Ries, formerly vice president and director of sales for Republic, replaces President Thomas R Navin, who died Sept 30. He has also been appointed to the board of directors of Gear Grinding, Republic, and its subsidiary, Detroit Bevel Gear Co. Mr Ries joined Republic in 1924 as a salesman; he was appointed sales manager in 1944, and vice president, director of sales in 1949. **Edgar D Leon,** president of Gear Grinding, takes over the late Mr Navin's post as president of Detroit Bevel Gear Co.

General Walter Bedell Smith, who recently retired as Under Secretary of State, has been elected vice chairman of American Machine & Foundry Co's board of directors. He will, according to the company, have broad administrative duties, and play a key policy-making role.

George Romney, formerly executive vice president of American Motors Corp, has been elected president and chairman of the board to succeed the late **George W Mason.** Mr Romney was also named general manager of the corporation, a consolidation of Hudson Motor Car and Nash-Kelvinator, of which he was executive vice president at the time of the merger last April.

Niels A Olsen has been appointed deputy director of the Department of Commerce's Metalworking Equipment Div, Business & Defense Services Administration. Mr. Olsen succeeds **James C Kelley,** recently appointed general manager of the American Machine Tool Distributors' Association. The new deputy director was with the Air Force from 1948 until this appointment; he most recently served in the office of the deputy chief of staff for materiel, assigned responsibilities in production planning in the field of metalworking equipment programming.

Walter Bedell Smith



Niels A Olsen

A B Drastrup has been elected president of A M Byers Co, Pittsburgh producer of wrought iron. He succeeds **L F Rains** who retired Oct 1 after heading the company for 23 years. Mr. Drastrup, executive vice president since February, joined the company in 1931 as plant auditor; he served as special assistant to the vice president in charge of operations during the war years, became manager of steel sales in 1946, and assistant to the president in 1951.

Marshall B Taft has been named general manager of Minneapolis-Honeywell Regulator Co's Valve Div. He succeeds **Stephen A Keller,** named general manager of the new Heiland Div in Denver. Mr Taft, formerly assistant to the president of the firm's Industrial Div in Philadelphia, will have responsibility for all phases of the division's activities.

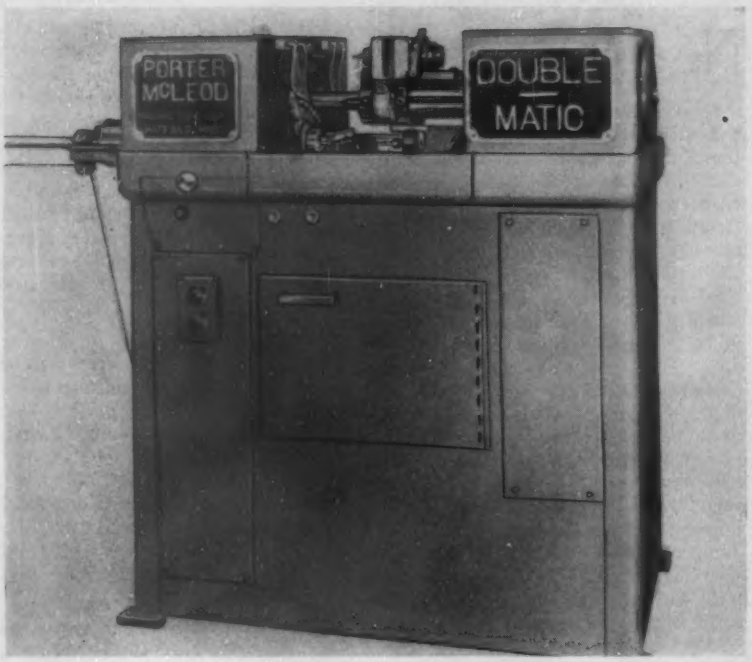
S G Hawley has been appointed works manager of Willys Motors, Toledo. He has served in executive manufacturing and engineering capacities with the company for 13 years. **D G Costello,** associated with the firm in various manufacturing posts since 1951, has been appointed production manager. **F A W Anger,** Kaiser auto production executive since 1946, has been named chief inspector.

OBITUARY

George W Mason, 63, president and chairman of the board of American Motors Corp, and head, since 1946, of the Automobile Manufacturers Association, died Oct 8 in Detroit. As president of Nash-Kelvinator Corp Mr Mason was instrumental in bringing about the merger of that company and Hudson Motor Car Co early this year.

Show in print

Products shown in this section have not been described previously in our pages. They will be exhibited at the National Metal Congress and Exposition International Amphitheater, Chicago, October 30 - November 5



Double-Matic Screw Machine Does First and Second Operations

Turret with axis parallel to spindle, and supported both at headstock and tailstock, has live spindle and collet in one turret position for receiving work before cutoff and supporting it for final operations on cut end.

Bar capacity is up to 1 in. dia, 4½ in. long; spindle speeds range from 400 to 3000 rpm; motor is 3 to 5 hp, running at 1800 rpm. Up to 20 gal. of coolant can be circulated. Machine takes up 57x27 in. of floor space.

All tooling and chucking operations are cam-operated, including front and rear slides. All shafts except low-speed ones run in ball bearings; the main spindle in two double-row bearings. Rigid turret mount allows heavy and fast cutting—for example, the machine can form, point, and cut off chrome-moly blanks for ½-in. centerdrills in under 20 sec.

Work lengths accurate to 2 or 3 thousandths are claimed possible because work feeds to stop, but is not clamped until turret has advanced to working position.

Porter-McLeod Machine Tool Co, Inc, Hatfield, Mass

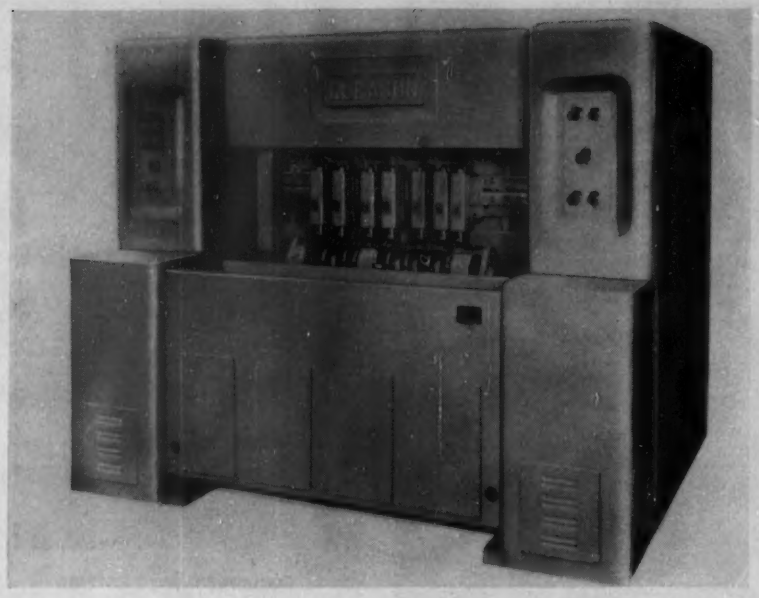
Unitized Vapor Degreasers In Various Types, Models

"Super" heavy-duty vapor degreaser incorporates specially developed sump pump which permits hand spraying with clean solvent to remove heavy greases or metal chips from parts. Barrels, 50-gal. galvanized units, are complete with leakproof spray pump of heavy-duty bronze, motor, hose, and lance.

Parts cleaning is accomplished automatically in pure, non-flammable trichlorethylene vapors. Cleaning is effected in less than a minute. Unitized degreasers can be moved from job to job.

Barrels of the "Super" have an unobstructed work area 23 in. in dia and a vapor depth of 18 in.

Baron Industries, 241 West Avenue 26, Los Angeles 31, Calif



Gleason Rolling Quench Press Stabilizes Hot Shafted Parts

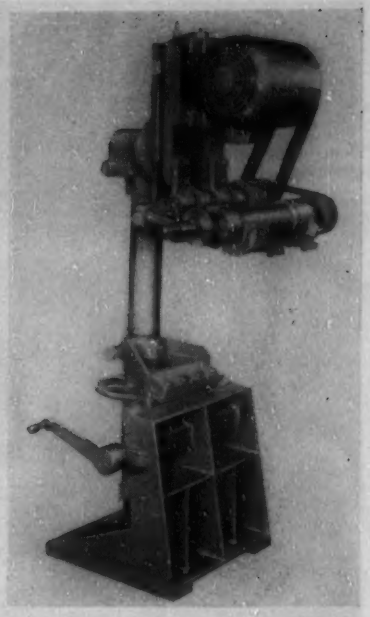
Rollers rotate round parts under heavy, but variable, pressure as oil is pumped over them in quenching press. Fluid flow up to 350 gph can be maintained; parts with dia from 9/16 to 4 in. and lengths from 6 to 43 in. can be handled.

Operation is entirely automatic except for work loading and starter button. Flow of oil to any part of work can be controlled to close limits. Rapid initial quench may be obtained, then slow temperature drop while stresses are equalized, and finally a rapid cooling quench to bring part to handling temperature.

Built-in pumping system and reservoir can use water, caustic, or other fluids.

Other presses, not illustrated, use flat dies to hold small, rings, or irregular parts while oil is passed through similar cycles.

Gleason Wks, Rochester 3, NY



Hammond Adds Medium-Duty Unit To Line of Finishing Machinery

Model 50-99 polishing and buffing head and stand unit is designed for medium-duty operations. Maximum float action of 4 in. allows head to follow the surface of irregular parts. Flat surfaces can also be finished without using the floating action. Power wheel feed can be furnished to enable operator to maintain correct pressure for uniform results.

Head is powered by a 3, 5, or 7½-hp 1750-rpm motor, or a 10-hp 3500-rpm unit. Net weight of over 1400 lb is said to assure vibrationless operation. Model is furnished with an ammeter as standard equipment.

Hammond Machinery Builders, 1618 Douglas Ave, Kalamazoo, Mich

Mobile Armorply Totebox

Container, constructed entirely of aluminum and veneer, weighs 29 lb. is 21 in. high, 25½ in. long, 18½ in. wide. Top and bottom plates are ¼ in. thick with 0.025 in. aluminum; both sides are of plywood. Remainder of box is made of a special forming grade of Armorply with a core of 1/10-in. Basswood veneer with an outer lining of 0.025-in. aluminum, and an inner lining of 0.015-in. aluminum.

US Plywood Corp, 55 West 44th St, New York 36

Machine Alloy Steels Result from Lead Addition

Rycut 40 is a 0.40-carbon chromemoly steel with from 0.15 to 0.35% lead, which has no effect on heat-treatment, but improves machinability from 25 to 75%, based on cutting speeds possible.

Advantages claimed are lead lubrication between tool and chip, faster chip breakup, better tool life by as much as 300%, better surface finish.

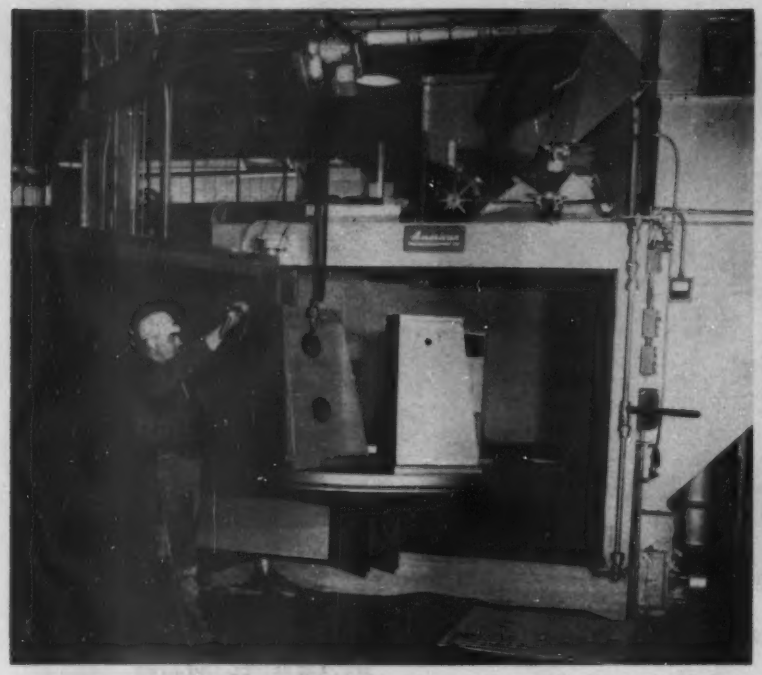
Joseph T Ryerson & Son, Inc, Box 8000-A, Chicago 80

Miscible Drawing Compound Mixes in Wide Range

Cold-forming compound mixes with water at ratios from equal parts up to 1:15, and is economical, easily-washed material. Mixture is of mineral oil, emulsifying agents, non-abrasive pigment, and dispersion additive, and is designed for difficult working conditions.

Laboratory and field tests show longer die life, increased output per hr, and lower unit costs. The compound can be left on a stored die, and the die will work later when returned to service. It has no objectionable odor.

The Texas Co, 135 E 42nd St, New York 17



Swing-Top Blasting Cleaner Needs No Abrasive Pit

Table-type airless blasting machine —the 72-in. Wheelabrator Swing Table—needs no pit for abrasive hopper, being built for floor-level installation.

Machine has 40-in. work-height clearance, and is intended for cleaning a wide range of work, such as castings, forgings, weldments, and stampings.

Worktable is 72 in. in diameter, mounted on door of machine. When door is opened, table comes out into room for loading and unloading. Shutting door moves table into blasting area. Centrifugal force drives abrasive, so that no air is required.

Loading and unloading are done with auxiliary tables, which can be alternated so one table is inside the blast area while the other is outside being loaded.

Special vestibules in walls of machine accommodate long pieces. Abrasive is used over and over, because conveyors carry spent abrasive to top of machine. Small particles and contaminants are removed and rejuvenated abrasive is re-entered into cleaning cycle.

American Wheelabrator & Equipment Corp, Mishawaka, Ind

Power Tools for Wire Insertion

Tools powered by air and electricity are designed for insertion of wire screw-thread inserts. These tools are for high production runs, providing threads in soft materials, such as non-ferrous metals, plastics, and wood. Characteristics include resistance to corrosion and thread stripping, heat resistance, and wear resistance where parts are assembled and dissassembled frequently.

Kit of 125 inserts, taps, manual inserting tools and extractor will be displayed.

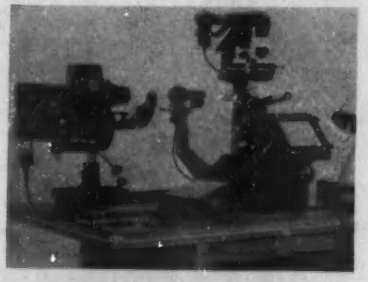
Heli-Coil Corp, Danbury, Conn

Portable Optical Pyrometer Measures to 1300F

Optical pyrometer is designed for lab use, but is portable for shop applications when needed. Measures to 1300F. The instrument will measure a target less then 0.001 in. diameter, and can be adjusted for focal distances from 5 in. to infinity. Tabletop and floor tripods are available, and vernier worm gears permit horizontal and vertical adjustment of telescope.

Optical system includes 20X microscope and wide-scale direct-reading meter makes it possible to reproduce temperatures with extreme accuracy. Carrying case for entire assembly is available. Catalog No. 95 illustrates and describes instrument in detail.

Pyrometer Instrument Co, Inc, Bergenfield, NJ

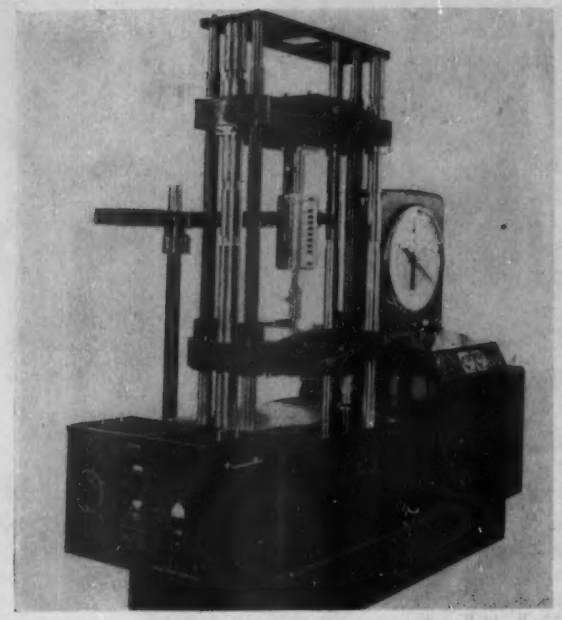


Metallograph Has Built-In Camera

Metallograph "MeF" has integral 4 x 5 in. camera adaptable for use with Graflock back and Polaroid Land Camera. Micro-hardness tester permits indentation by Vickers diamond in spot previously selected with objective of Metallograph.

Other features include interference tester, phase contrast for metallurgy, grain-size measuring equipment, and vibration eliminator.

William J Hacker & Co, Inc, 82 Beaver St, New York 5

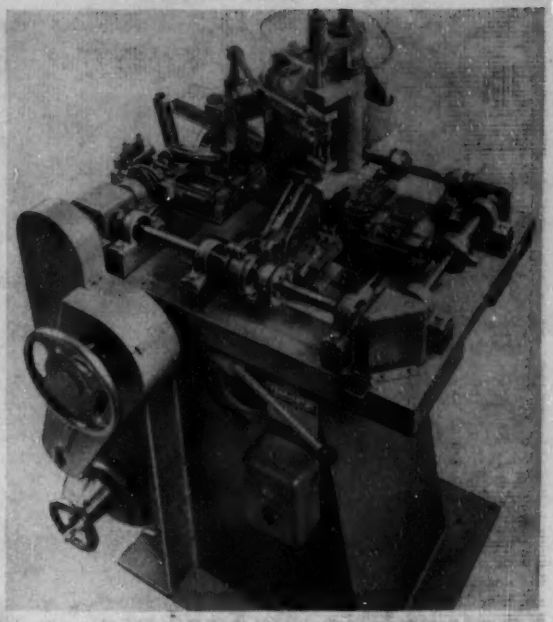


Machine Tests Alloy Reactions During Forming

Riehle universal testing machine was designed to determine how metal alloys will react during forming operations and in use at high temperatures. The machine can utilize electric furnaces producing temperatures to 1750 F and permits installation of multiple furnaces for production testing.

Screw-powered, the universal tester provides positive control of testing speed and maintains a constant rate of strain at any speed setting. It accommodates specimen diameters from 0.252 to 0.505 in.

American Machine and Metals, Inc, East Moline, Ill



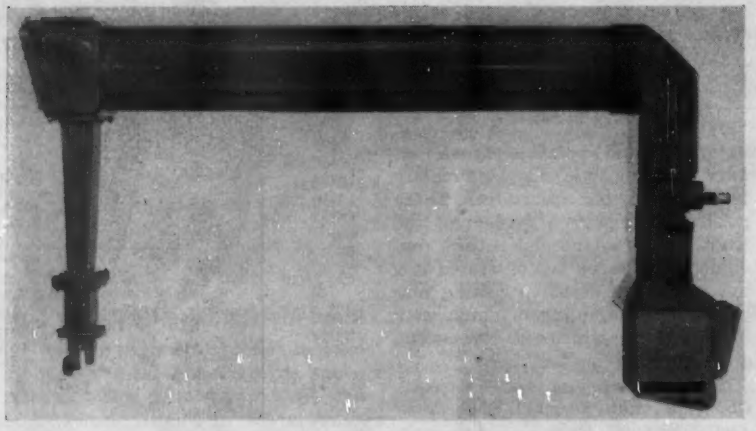
Torsion Spring Winder Has Large Tooling Area

Torsion spring winder is capable of handling up to ten turns of 0.080-in. wire. Tooling area of the W-3001 is 34 x 38 in. Driven by a motorized variable speed transmission and V-belt drive, it is equipped with two sizes of slide feeds—one handling up to 3½ in. of wire and the second feeding wire ranging up to 6¼ in.

The winder's tool slides include two horizontal units, one right- and one left-handed, and a vertical two-slide attachment available for use with the horizontal slides. Additional horizontal slides, coupled with shafts on three sides of the tool area, permit the production of various and complex wire forms. Change gears for hardened steel spindle are mounted on winding head's top.

The W-3001 winders are equipped with gears for 10 and 24 turns of the spindle. A set of gears for 47 turns is also available.

The Torrington Manufacturing Co, Torrington, Conn



Remote Observing Mechanism Has 3-D Feature

Remote stereomicroscope permits safe examination of dangerous subjects or watching machines work in danger areas with stereo view. Stereo photos may be taken through the mechanism with a 5x7-in. camera, producing two 3x4½ prints.

Magnifications from ½ to 30X are possible. Length of optical system is enough to move images about 5 ft back from actual location. Lens elements are non-browning.

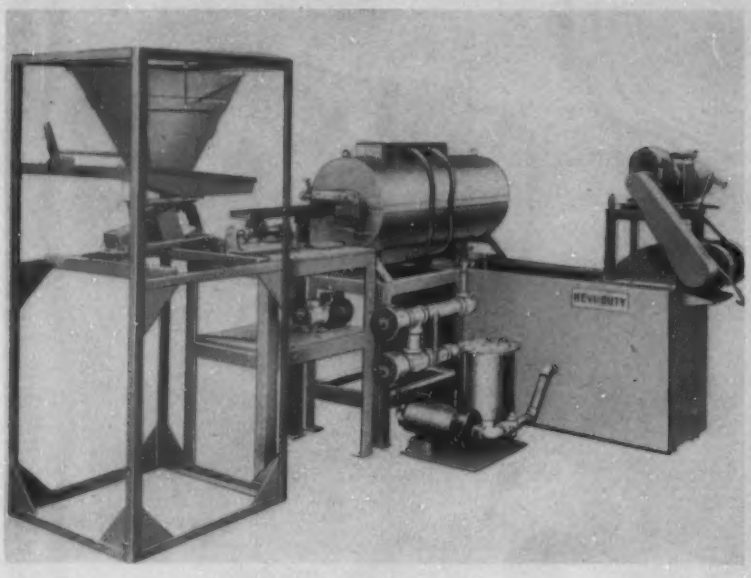
Bausch & Lomb Optical Co, Rochester 2, NY

Plastic Cam Controls Predetermined Oven Temperatures

Electronic dynamaster time-temperature program controller has clear-plastic cam, cut for each operation, added to controller face so it will make temperature controls follow charted path. Optional on-off or proportional inputs are available.

Bristol will also present metal-ceramic thermocouple tubes.

Bristol Co, Waterbury 20, Conn



Shaker Hearth Furnace Has Automatic Features

Shaker hearth furnace is equipped with an automatic parts feeder; a quench tank conveyor for removing treated parts; and a Quench-O-Trol unit for maintaining exact temperature of the quenching oil.

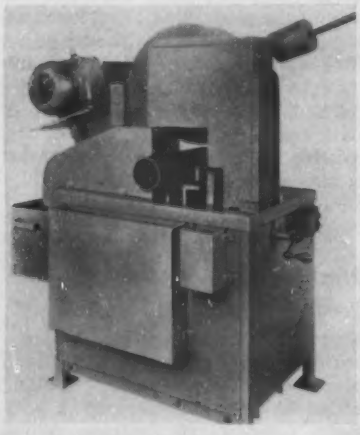
Furnace can be used for hardening, carburizing, dry cyaniding, and similar heat-treating operations requiring temperatures to 1900 F. Standard sizes have capacities up to 175 lb of parts per hour. These are fed from a hopper onto the oscillating hearth plate which moves them through the heating zone and discharges them directly into the oil quench. Quench tank is provided with two perforated baskets for hand removal, or a conveyor may be installed for automatic operation. An oil cooling or heating and circulating system may be supplied as an accessory.

Hevi Duty Electric Co, Milwaukee 1

Cutoff Machine Processes Large Solids and Structurals

Raybestos-Manhattan's rubber and resinoid bond cutoff wheels, 18 and 20-in.-dia, are shown on a new cutoff machine made by Henry H Wise Co, Los Angeles. The chop-stroke unit has a heavy-duty 15-hp motor, giving it capacity to cut large solids, steel pipe, and structurals. Chain hold-down vise secures material while cutting.

Raybestos-Manhattan, Inc, Manhattan Rubber Div, Passaic, NJ



Abrasive Cutting Machine

Dry-abrasive cutting machine, Severall is one of the new models in the line of cutoff and nibbling machines. It is being manufactured in both stationary and portable types, attains a cutting time of approximately three seconds per square inch. There is also an improved version of the Hudorkut, a submerged cutting machine. Also to be demonstrated is a bar stock wet abrasive cutting machine and a nibbling machine with 375 to 650 spm which cuts low carbon steel up to ¼-in. thickness.

Campbell Machine Div, American Chain & Cable Co, 929 Connecticut Ave, Bridgeport, Conn

Industrial Gloves

Jomac gloves are said to be particularly effective for handling metal sheets, plates, and parts that are hot, sharp-edged, or oily. Jomac cloth is a twisted loop pile fabric. Gloves are also available with plastic coating known as Armorkote.

Jomac, Inc, 6128 North Woodstock St, Philadelphia 38, Pa

Klosd Motors Raise Hp, Lower Size

Normal speed electric motors in frame sizes 182 and 184 are built to new NEMA standards, which specify more power in smaller frame. According to manufacturer, Klosd motors 182 and 184 eliminate 50% of inactive space in previous designs; diagonal cover boxes may rotate 360° to be fixed in any position and have tapped hole for conduit. Insulation, brackets, and bearing seals are also said to be improved. Larger sizes built to NEMA standards will be introduced at later date.

Sterling Electric Motors, Inc, 5401 Telegraph Rd, Los Angeles 22

FYI

FOR YOUR INFORMATION

FREE Catalogs, Booklets, Charts, Calculators

FYI—these initials symbolize information that's important. And there is much of importance in the literature listed here. To get the ones you need, all you do is fill out one coupon for each booklet you wish to order. Indicate in the circle on the coupon the number of one catalog wanted. When you have filled out a card, detach, stamp, and mail. We'll do the rest.

MACHINES AND ATTACHMENTS

1 PRESSES — *Niagara Machine & Tool Works, Buffalo 11.* 27-page illustrated bulletin 66 covers line of straight-side, single-action eccentric-geared Series SE-1, 2, and 4. Describes features, includes tabulated specifications for 100 to 1000-ton line in one, two, and four-point designs.

2 VERTICAL MILLER — *Reed-Prentice Corp, Worcester 4, Mass.* 6-page brochure illustrates and describes heavy-duty No. 4 machine with electronic control for all feeds. Two models provide 60- or 96-in. table travel; rate of speed from ½ to 25 ipm; spindle speeds up to 1800 rpm.

3 GRINDING WHEELS & HONES—*Norton Co, Worcester 6, Mass.* 52-page catalog 1233 contains comprehensive assortment of standard sizes. Data on markings, selection, shapes, suggestions on use, and price listings.

4 INJECTION MOLDING MACHINE —*F J Stokes Machine Co, Philadelphia 20.* 6-page bulletin 560 describes new 4-oz unit designed to give positive ejection and production of finished, degated pieces. Specifications, construction, operational, and production economies achieved by Model 700 presented.

5 MULTIPLE-WHEEL GRINDERS—*—Landis Tool Co, Waynesboro, Pa.* 12-page catalog P-54 covers 10- and 14-in. H-IW units for grinding diameters simultaneously. Illustrates 12 different tooling setups for various shafts. Describes machine and specifications.

6 POWER MACHINE CONTROL—*—Modernair Corp, San Leandro, Calif.* Packaged "PMC" pneumatic control for presses, brakes, shears, and other machines utilizing mechanical clutches described; reduces operator fatigue, improves protection on hazardous machinery. Available in either 2- or 3-in. cylinder bores and any desired stroke length.

7 CUTTER GRINDING AIDS — *Ingersoll Milling Machine Co, Rockford, Ill.* 52-page booklet 59K describes recommended milling cutter grinds for different materials, types of cuts, and quality of finish required. Presents data and drawings on 14 basic grinds; tables give speeds and feeds for face milling and finger settings used for grinding various primary clearances; information on causes of chatter, and a carbide comparison chart.

8 POWER-GROOVER — *Niagara Machine & Tool Works, Buffalo 11.* 4-page bulletin 76-B covers Model 48-U universal unit for closing both single and Pittsburgh lock seams. Detailed information and specifications, and illustrations of both types of seaming.

9 ELECTRONIC MACHINING & GRINDING—*Elox Corp of Michigan, Clawson, Mich.* Complete fact file explains process in eight individual bulletins. Includes cost analysis of different machining jobs, how electrodes are made, how to convert from diamond to electronic grinding, and case histories.

10 HYDRAULIC PRESSES — *M&N Hydraulic Press Co, Clifton, NJ.* 4-page bulletin 502A covers line of deep drawing hydraulic units; 10 to 600 tons. Design features illustrated.

11 GRINDING MACHINES; CUTOFF MACHINES — *Lobdell United Co, Wilmington 99, Del.* 4-page bulletin covers Bridgeport line of grinders; contains illustrations, specifications, features of face and knife, vertical surface, traveling head knife, and floor grinders. Bridgeport "Abrasaw" cutoff machine bulletin illustrates performance data, gives specifications.

TOOLS AND ACCESSORIES

● TURRET LATHE TOOLS — *Warner & Swasey Co, Cleveland, Ohio.* 197-page seventh edition contains illustrated listings of standard tools, chucks, collets, and miscellaneous equipment. Detailed dimensions and clearances, as well as complete data sheets for all W&S turret lathes simplify tool designing and setup. Tables of decimal equivalents, diagonals of hexagons and squares, surface speeds, and recommended speeds and feeds for various materials and cutters included. Request direct on company letterhead.

12 PRECISION TOOLS—*R B Tool Co, Inc, White Plains, NY.* 4-page catalog 104 illustrates "BH" boring bars with half-elliptical carbide bits. Shank diameters range from ⅝ up to 1¼ in. Data on bar sets provided, as well as bar and bit prices and dimensions.

13 AIR-POWERED VISES — *Vau Products Co, Erie, Pa.* 4-page brochure describes Vi-Speed units in time-saving applications in production-holding and pressing jobs. Covers use of

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FOR YOUR INFORMATION

special jaw faces, unusual mountings, use of two or more units operating from a single foot-controlled valve.

14 SURFACE PLATE SPECIFICATIONS — *Rahn Granite Surface Plate Co, Dayton 7, Ohio.* 4-page folder explains formula for accuracy and outlines simplified method of obtaining it. Diagrams help determine amount of accuracy needed for type of work handled.

15 CUTTING TOOLS — *Genesee Mfg Co, Rochester 21, NY.* 46-page catalog 54 illustrates, describes, and gives specifications of adjustable hollow mills for cutting steel, cast-iron, and non-ferrous metals. Contains similar data on facing and c'boring tools, and on tube burring tools.

16 GAGE SELECTOR — *Threadwell Tap & Die Co, Greenfield, Mass.* Measures 2¾ x 6 in.; can be used for both ring and plug gages in fractional or numbered sizes. Gives short, concise definition of classes and specifications on how to order.

17 ASSESSMENT OF SURFACE FINISH—*William J Hacker & Co, New York 5.* 10-page booklet explains optical method for testing surface of materials, including metals, plastics, glass. Describes accurate and convenient system for examination and assessment of surface finish.

18 DIES—*Vascoloy-Ramet Corp, Waukegan, Ill.* 6-page catalog VR-461 lists 22 sizes of round hole dies; 13 sizes each of square, hexagon, and rectangular shape. Includes complete ordering information and specifications on all V-R dies for drawing wire, rod, bar, and tube.

19 INDUSTRIAL CONTROL COUNTERS—*Potter Instrument Co, Great Neck, NY.* 20-page booklet contains detailed descriptions of equipment and techniques for controlling equipment by predetermined electronic counters. Typical applications explained and illustrated in detailed diagrams.

20 BENCH GAGE — *Bryant Chucking Grinder Co, Springfield, Vt.* Bulletin 21 describes Model 21 for inspection of internal and external threads. Checks threads in all tolerance classes and in sizes ranging from 5/16 to 5-in.-dia for internal threads, and No. 8 to 5-in.-dia for externals.

● GEAR TESTERS — *George Scherr Co, New York 12.* 100-page book describes all models of the Mahr (German) line, including composite units for external and internal gears, tooth space checker, involute testers, pitch circle testers. Contains information on most modern methods of testing and inspecting, and various gear tables. Request direct on company letterhead.

HEAT-TREATING AND WELDING

21 PROJECTION & SPOT WELDERS —*Sciaky Bros, Chicago, Ill.* 8-page booklet 324-2 covers all phases of the standard SP1 and EP1 series air-operated, press type, low-impedance, single-phase units. Also included is the ESP1 combination projection-spot welder. Gives applications, schematic drawings, and tabular data.

22 HARD-FACING RODS & ELECTRODES—*Mir-O-Cal Alloy Co, Los Angeles 21, Calif.* Comparison chart lists various kinds produced by 29 different manufacturers. Abrasion and impact qualities of each listed, as well as many of its applications. Also gives individual hardness ratings, both as deposited and work-hardened, or heat-treated.

23 WELDING PROBLEMS — *Eutectic Welding Alloys Corp, Flushing, NY.* 8-page illustrated booklet on how to overcome problems and improve techniques. Variables are mentioned and explained; causes of stress raisers, starter cracks and hard spots discussed, and methods indicated for avoiding or minimizing.

PLANT SERVICE EQUIPMENT

24 VACUUM METALLIZING — *F J Stokes Machine Co, Philadelphia 20.* 21-page catalog 780 describes low-cost finishing process: depositing of a thin coating of metal by evaporation and condensation under high vacuum conditions. Provides metallic finish on any base material, without buffing or polishing.

25 CENTRIFUGAL BLOWERS & EXHAUSTERS—*Air Appliance Div, US Hoffman Machinery Corp, New York 3.* 12-page bulletin M-103 describes multi-stage units for applications requiring air pressure from 1 to 9 psi, or vacuum from 2 to 12 in. of mercury. Gives design features and advantages, and capacity-range charts.

26 BATTERY MAINTENANCE TRAINING MANUAL — *Gould-National Batteries, Trenton 7, NJ.* 44-page illustrated technical training manual, with diagrams and tables, on lead-acid storage batteries for electric industrial truck use.

27 RUST-INHIBITING PRIMER — *Rusticide Products Co, Cleveland 14.* 4-page brochure describes metal treatment, called OSPHO, which forms a bond between rusted metal and new paint; stops rust action.

28 VARIABLE DELIVERY PUMPS — *The Oilgear Co, Milwaukee 4.* 8-page bulletin 47010 illustrates and describes Type A packaged pumps for both straight line or rotary drive applications. JIC circuits of pumps for differential and non-differential systems, diagrams of straight line and rotary drives and installation dimensions are included.

PARTS & MATERIALS

29 TITANIUM — *Rem-Cru Titanium, Midland, Pa.* 12-page reprint of five articles on fabricating; gives characteristics of alloys; covers grinding; hot-working; heat-treating; and forming.

30 VALVES—*Crane Co, Chicago, Ill.* 20-page illustrated pamphlet, "Choosing the Right Valve," covers principal types; basic gate and globe designs; check valves; names of parts; seating designs; selection, etc.

31 ANCHOR BUSHINGS — *The Hi-Shear Rivet Tool Co, Los Angeles 45.* 23-page 4th edition catalog for sheet metal and laminate plastic drill templets. Includes comparisons of tooling methods, layout dimensions, and size chart.

32 FORGINGS — *The Cleveland Hardware & Forging Co, Cleveland 4.* 40-page catalog 19A lists dimensions, details, tables, sizes, and specifications of almost every stock forging type produced for the automotive and industrial fields. Lists part numbers in sequence, by product, and in numerical order.

33 SPEED REDUCERS — *Cone-Drive Gears Div, Michigan Tool Co, Detroit 12.* 8-page bulletin CD-323 provides illustrated information on shaft-mounted cone-drive units with double-enveloping worm gearing. Provides engineering details for proper selection for specific applications; dimensioned drawings; tables of bore sizes.

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Next Steps in Atomic Progress . . . A Challenge to American Industry

The purpose of this editorial is to throw light on the significance for American industry of recent changes in the statutes that control the development of atomic energy.

The need for clear light on the meaning of this new legislation is made more urgent by the political confusion and distortion that marked its course through Congress. The politically inspired charges of "giveaway" that delayed its passage—charges that were almost totally unrelated to the legislation itself—helped to obscure the vital importance of the step finally taken by Congress.

In sober, post-Congressional fact, the principal significance of the new atomic legislation is that it extends to private enterprise responsibility for the development of peaceful uses of atomic energy, whereas heretofore this responsibility has rested in a tight government monopoly. **And this extension is made on terms that emphasize the responsibility far more than they open any opportunity for economic gain in fulfilling it.** The revised Atomic Energy Act provides that:

1. Industry may now own and operate its own nuclear reactors, under license from the Atomic Energy Commission. And it may build and sell nuclear reactors for export.

2. Industry may use—but not own—nuclear materials at the discretion of the Atomic Energy Commission.

3. The Atomic Energy Commission will make available to industry scientific knowledge that may be useful in developing peaceful applications of nuclear energy.

4. For the first time, industry will have the right to patent inventions in the field of nonmilitary nuclear energy. However, "basic" discoveries must be made available to all companies in the field for a period of five years, after which they, too, will revert to normal patent status.

Two Kinds of Know-How

These provisions, despite the imposed limitations, represent the first positive step toward development of nuclear energy for peaceful applications in the United States. Potentially useful knowledge, previously locked in the minds of government scientists, will now be available to all those who are willing and able to put it to work for the good of mankind.

The advantages to be gained from enlisting the talents of American industry in the development of peaceful atomic applications are imposing. As *The* (London) *Economist*, Europe's leading economic journal, recently remarked, "The atomic scientists are in a position to surmise how atomic energy can be applied... but they lack the specialized knowledge of engineering design and operating technique just as industry itself lacks atomic knowledge." Now the engineers of private industry need no longer lack the atomic knowledge, and there is granted to them at least a restricted freedom to apply it to the solution of their engineering and operating problems.

But the new opportunity for private industry to find constructive uses for the science of nucleonics carries with it a grave responsibility. These uses must be so developed that they will benefit the people of all the free nations. It is essential that the United States, which pioneered in developing lethal uses for atomic fission, demonstrate to the world our paramount interest in its peaceful application. It would be a moral set-back to the free world almost beyond calculation if the Communists should be able to offer to the poorer nations of the world the benefit of low cost atomic power—provided by Communist technicians—while we concentrate primarily on building our stockpile of atomic and hydrogen bombs.

Race For a Peaceful Victory

Most of the experts are agreed that it may be many years—perhaps ten, fifteen or more—before the cost of electricity from atomic fission can be reduced to a level that will make it competitive with conventionally produced power in most regions of the United States. But most of the world is not nearly so fortunate as we are in power resources. Electricity, even at a cost far higher than the average that prevails in the United States, would be a blessing in many countries, and the nation that provides the technology to bring it into being will score a great moral victory.

The useful potential of nuclear energy is not restricted to the generation of electric power—although twenty years from now this use will be highly important to the power industry of the United States. Even with the limited research that has been done in this field thus far, the use of radioisotopes—the radioactive products of atomic reactors—is saving American industry an estimated $100 million a year. Commissioner Campbell of the AEC, who made this estimate, believes that these savings may well reach $1 billion a year within ten years. Radioisotopes are already at work in industries ranging all the way from paper manufacturing, where they measure paper thickness, to pipeline transportation, where they mark the dividing lines between shipments of different products (at an estimated saving of $500,000 a year). Medical applications of these same radioisotopes hold promise of longer and more comfortable lives for those who are stricken by cancer and other diseases.

Above All a Challenge

The new Atomic Energy Act is a crucial stride toward the day when all these benefits—and undoubtedly others not yet revealed by research—will be realized. But it is a step that is essentially permissive. It still leaves it to private industry for the most part to decide what is to be done and how soon.

The new act is thus, above all, a challenge. It confers on private industry the responsibility to assume a leading role in the development of peaceful uses for nuclear energy, a step long urged by NUCLEONICS, a McGraw-Hill magazine devoted to atomic energy. To achieve a success in this task that will measure up to the requirement of the national interest, this development must command all the resources and ingenuity that private enterprise can apply—and do so without promise of glittering prizes surely to be won. **But now that the responsibility has been defined and the challenge offered, American industry will, we believe, measure up to its grave and mighty import.**

This message is one of a series prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nationwide developments that are of particular concern to the business and professional community served by our industrial and technical publications.

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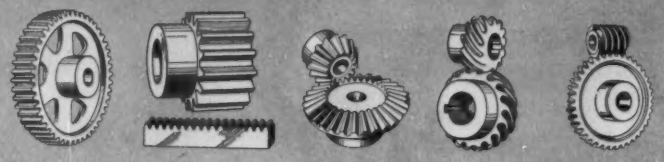
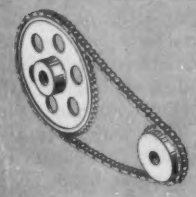
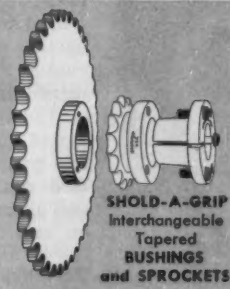


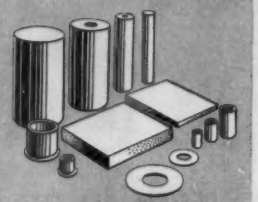
STOCK GEARS: Spur • Racks • Miter • Bevel • Helical • Worms and Worm Gears



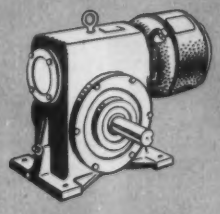
SPROCKETS and CHAIN
For drives ranging from fractional to 40 hp



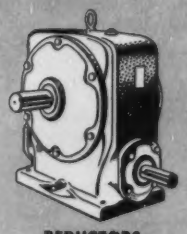
SHOLD-A-GRIP Interchangeable Tapered BUSHINGS and SPROCKETS
Fit sprockets up to 24" pitch dia. to any shafts ½" to 3" by 16ths



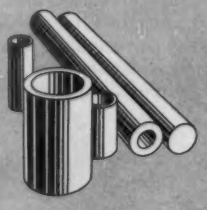
BOST-BRONZ oil-impregnated BEARINGS



RATIOMOTORS
Motorized Speed Reducers
32 types—1/20 hp to 3 hp



REDUCTORS
Standardized Speed Reducers
.005 hp to 36 hp



Certified BEAR-N-BRONZ Solid Bronze BEARINGS

PILLOW BLOCKS

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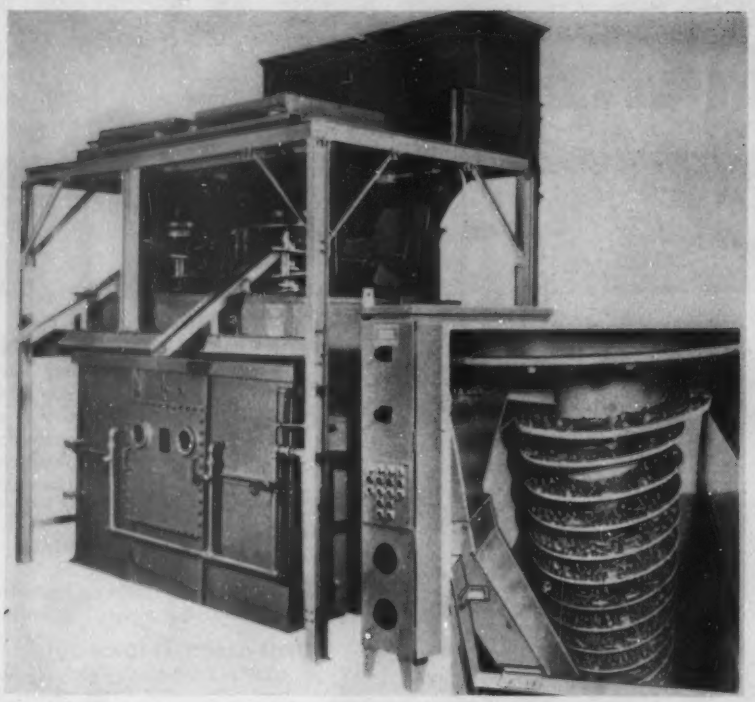


Degreaser Loaded and Unloaded By Vibratory Feeder, Elevator

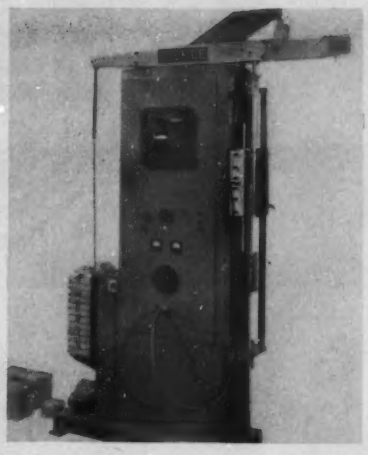
Vibratory degreaser is loaded from a hopper, with parts automatically fed at a constant rate, using a vibratory motion of the spiral elevator.

While in the bath, parts are agitated by the vibratory motion of the spiral elevator, which can be controlled for rate of movement. Vibration comes from electro-magnet powered by pulsating current.

Baskets do not have to be loaded and unloaded into the bath, and the design of the feed eliminates moving parts such as chains, shafts, and sprockets.

Furnished with complete control unit, and can be heated by gas, steam, or electricity.

Manufacturers Processing Co, 1560 Hilton Rd, Detroit 20, Mich



TESTING MACHINE with 12,000-lb capacity determines the stress required to rupture specimens as well as the creep properties up to the rupture. The machine can be furnished as a complete package, ready to function, and including a ball-seated loading clevis, furnace, control panel and local wiring, motorized weight elevator, hydraulic recoil absorber, automatic beam leveler, and creep measuring equipment *—American Machine and Metals, Inc, East Moline, Ill*

Lightweight Air Filters

Model 4MA filter handles air and liquids, and Model 4M10 handles liquids at pressures up to 4000 psi. Units are all steel, made from a single tube. Air model handles 3.4 cfm at 1000 psi, 1.5 cfm at 4000 psi. Filters have honeycomb elements.

Another unit, Model 2123-SP33D, is a floor-mounting unit that handles 330 gpm. All filters remove particles down to microscopic size.

Commercial Filters Corp, 2 Main St, Melrose 76, Mass

Tabletop Copyflex Makes Prints 11 in. Wide

Smaller prints, up to 11 in. by any length desired, are handled at 14 fpm by Model 100, a diazo-direct copying unit that requires only electrical power to be operated.

Machine makes positive prints directly and can copy printed or typed matter as well as tracings and sketches. Unit is compact and simple.

Charles Bruning Co, 4700 Montrose Ave, Chicago 41

High-Speed Electrodes

Murex contact arc welding electrodes have heavy coatings containing a high percentage of iron powder. During welding, powder enters the weld, supplementing the metal derived from the core wire, and is said to provide rates of deposit approximately twice those of a conventional E-6012 electrode.

In addition, it is claimed that powdered iron contributes to smooth arc action and elimination of undercutting, and assures high crack resistance.

Metal & Thermit Corp, 100 E 42nd St, New York 17, NY

AIRCRAFT PARTS HARD TO HANDLE?

NOT WITH THIS NEW LELAND-GIFFORD DRILLING MACHINE

Developed in 1951 for one of the world's largest and most respected builders of piston and jet aircraft engines, this Leland-Gifford Drilling Machine has served so well that dozens more have been installed and some of these augmented by additional columns. It has proved a particularly successful solution to the problem of drilling and tapping large, annular, stainless steel pieces such as compressor, diffuser and turbine exhaust bases... bulky parts which are normally hard to handle.

Some of the outstanding features of this machine are:

- **24 inch Overhang**
- **Large 42 x 78 inch Platen**
- **8 Spindle Speeds from 90 to 3600 RPM**
- **Single or Multiple Spindles**
- **12 inch Spindle Travel**
- **Provision for Additional Columns**
- **Power Feed or Reversing Motor Tapper**

The flexibility of this design plus the inherent accuracy and operating ease found in all Leland-Gifford Drilling Machines make this unit a worthy addition to the drilling and tapping facilities of any plant. Why not ask your near-by Leland-Gifford sales engineer for complete information?

EXEMPLIFYING NEW ENGLAND CRAFTSMANSHIP

LELAND-GIFFORD
Drilling Machines
WORCESTER 1, MASSACHUSETTS, U.S.A.

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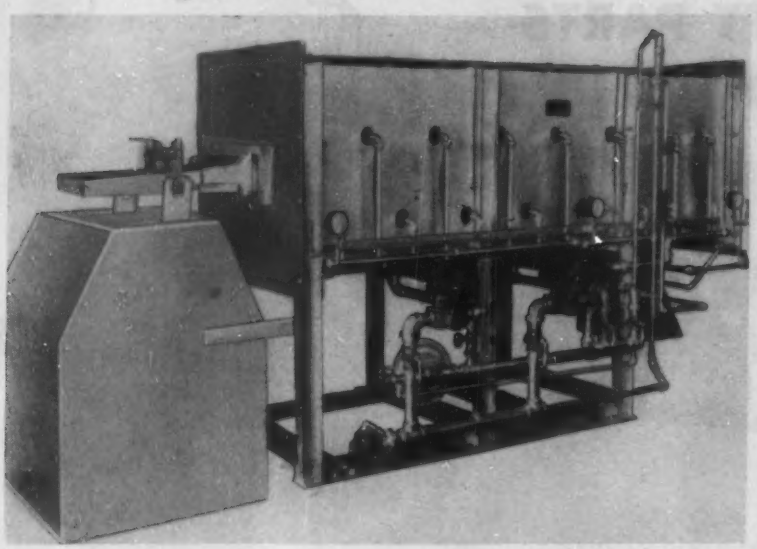
  2515 West Peterson Ave.
- **DETROIT**
  10429 West McNichols Rd.
- **CLEVELAND 21**
  P. O. Box 217
- **NEW YORK OFFICE**
  75 South Orange Ave.
  South Orange, N. J.
- **LOS ANGELES OFFICE**
  2620 Leonis Blvd., Vernon 58, Cal.
- **INDIANAPOLIS 6**
  P. O. Box 1051
- **ROCHESTER 18**
  P. O. Box 67, Rosslawn Station



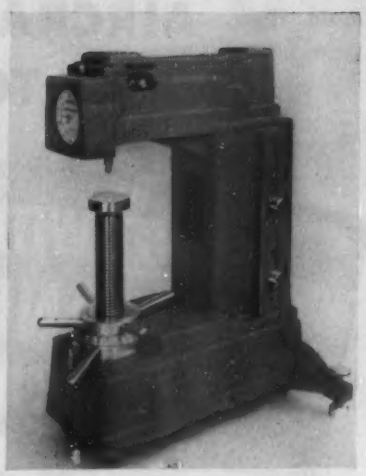
Reciprocating Furnace Employs New Method for Conveying Work

Model 230 reciprocating furnace is designed for controlled-atmosphere production heat-treating of stampings, screw machine parts, forgings.

Principle of imparting momentum to the work by reciprocating the work-conveying hearth back and forth is employed to advance parts through the processing cycle. A movable alloy hearth is used within a fully sealed stationary muffle; discharge throat of the muffle seals directly into the quenching medium. Lightest and most delicate work can reportedly be handled without distortion.

Units are available in production capacities up to 600 lb per hr.

American Gas Furnace Co, Elizabeth, NJ



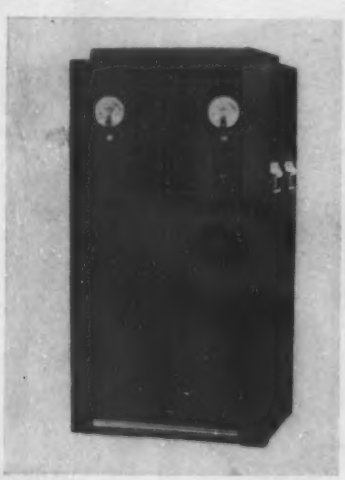
Surface Hardness Tester Checks On Several Scales

Kentrall hardness tester measures regular and superficial Rockwell hardness with any suitable standard indentor. All results are shown on a direct-reading dial gage, with one numerical scale.

Minor and major loads are applied only with weights (no springs) which are completely enclosed in the casting, which prevents loss from exposure or handling. Changing from one test load to another is done by inserting stops on the side of the column.

Three-point base has built-in leveling screws. Standard equipment includes all weights for regular and superficial testing; also, 1/16-in. steel ball indentor, 4 anvils, and 4 test blocks; diamond and special indentors are available.

The Torsion Balance Co, Clifton, NJ



Ultrasonic Generator For Heavy Cleaning

Sonogen 2000 is a heavy-duty, 2-kw generator feeding power out at 100,000 cps, and can drive a 100-sq-in. transducer to clean parts in a solvent tank. Vibrations at this cyclic rate set up violent agitation in solvent, shaking loose dirt and grease from metal parts almost instantly.

Ultrasonic cleaning is recommended for small parts difficult to clean, such as knurled pieces, and can also decontaminate radioactive parts when set up to work remotely. Large parts are cleaned by shifting them to to the relatively small working area at the transducer.

Ultrasonic power may also be used for mixing fluids and accelerating chemical reactions. Unit is cooled by forced air; measures 43x23x18½ in., weighs 350 lb.

Branson Ultrasonic Co, 430 Fairfield Ave, Stamford, Conn

Testing Machines and Controllers

Tinius Olsen has added a hand-operated Brinell testing machine to its line.

In addition, the company is introducing an automatic rate of strain controller, and an automatic testing program controller.

Tinius Olsen Testing Machine Co, Easton Rd, Willow Grove, Pa

Continuous Strip Furnace Anneals at 190 fpm

Direct-fired gas furnace softens brass strip from 0.004 in. thick upwards at speeds to 190 fpm. Strip travels vertically down through furnace, between two refractory walls studded with radiant cup burners, and into quench area where combination of steam and hot water circulates. No exposure to outside atmosphere.

Other materials such as nickel, aluminum, magnesium, and other alloys can be annealed in the same furnace. Furnace is recommended where small floor space, flexibility, and low maintenance costs are desired. One furnace has operated in industry with no burner replacement after a year.

Selas Corp of America, Erie Ave & D St, Philadelphia 34

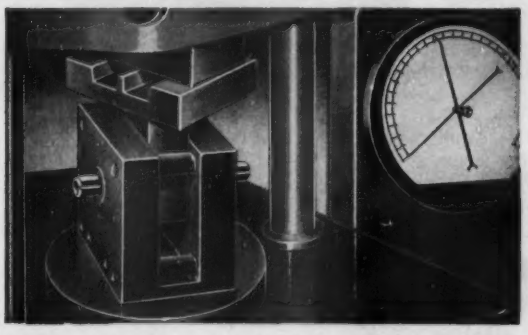
consistent strength... as important in the pin as in the socket

Normal leverage puts the load on the pins at these points. Pins must have a high resistance to shearing — and every pin must stand up to plenty of abuse. Many manufacturers' tests have proved Rollpin's uniformly high shear strength.

The Moore Drop Forging Company, who manufactures the famous Craftsman wrenches for Sears Roebuck and Co., used stainless steel rivets to fasten the universal joint on their Flex sockets. Thorough testing, under all possible load conditions and drive angles, convinced them that Rollpin was stronger than the stainless steel rivet previously used. This led to a redesign of the joint with Rollpins replacing the rivets. Also, the spring tension inherent in the Rollpin locking principle was used to provide the "drag" that holds the socket head in angular position. The result . . . an improved product at lower cost.

Dependability like this is based on the rigid ESNA® quality controls that insure consistent strength and mean reliable performance by every Rollpin.

Moore Drop Forging Company was able to save assembly time, too. Rollpin is simply driven into holes drilled to normal production tolerances. It compresses as driven, locking itself in place by exerting pressure on the hole walls. In this case, the extra operation of spinning on a rivet head was eliminated.



We urge you to test spring pins before you buy — for uniformity of diameter and length, hardness, insertion and removal forces, and recovery of diameter, as well as shear strength.

ELASTIC STOP NUT CORPORATION OF AMERICA

Dept. R29-109, Elastic Stop Nut Corporation of America
2330 Vauxhall Road, Union, New Jersey

Please send me the following free fastening information:

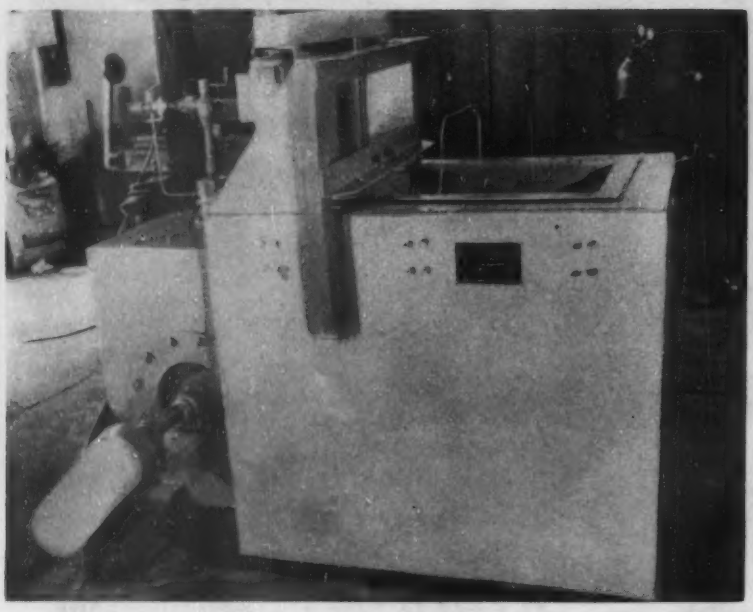
☐ Rollpin samples
☐ Rollpin bulletin
☐ Here is a drawing of our product. What self-locking fastener would you suggest?

Name_____ Title_____

Firm_____

Street_____

City_____ Zone_____ State_____



Gas Quenching Unit Circulates Salt or Oil

Operating range of 300 to 800F is maintained by hot air circulated around all pot surfaces. Cool air is admixed with circulating gases when temperature rises too high, and gas is cut back in if temperature drops.

Hot salt or oil in pot are agitated by propellor and ductwork that allow controllable liquid velocity. Filters may be used to remove salts. Initial cost of unit is claimed lower than other methods of heating.

Industrial Heating Co, 3570 Fremont Pl, Detroit 7

Portable Battery Unit Powers Stud Welders

Studs up to a ½-in. base dia are welded where power lines are not available or welding capacity would be exceeded by equipment operated by hand-truck unit. Twelve 150-amp-hr batteries are carried.

Recharging equipment is automatic. It operates from 115-volt line, using maximum of 15 amp, and makes open-circuit voltage checks every ten minutes while charging.

Welding guns, accessories, and studs can be stored in extra space within the truck.

KSM Products, Inc, 322 Woodland Ave, Merchantville 8, NJ

Non-volatile Detergent Cleaner Replaces Inflammable Materials

Houghto-Clean 402-403 is alkaline cleaner for removal of ordinary shop soils with minimum of agitation of work. Detergent and wetting agent is non-volatile, and non-inflammable.

Also being introduced are 313-A phosphate cleaner for preparing iron and steel parts for paint adhesion, and 313-NF for non-ferrous surfaces to be painted. These latter agents remove soil and deposit light phosphate coating to retard or resist corrosion.

Houghto-Phos, another conditioner, applies zinc phosphate to aid adhesion of final coatings or to act as base to ease drawing or extrusion.

E F Houghton & Co, 303 W Lehigh Ave, Philadelphia 33, Penna

Machine Spindle Line

Precision spindles for machine-tool and shop use to be shown include a heavy-duty work-head unit for vertical mounting, a heavy-duty spindle for horizontal operation, a motorized spindle designed for internal grinding on a horizontal boring, drilling, and milling machine, and a precision spindle with wheel flanges for large-bore grinding wheels. The grinder spindle will traverse 4½ in. when powered by leadscrew or pushrod, with bellows protecting the spindle itself from grit damage.

Standard Electrical Tool Co, 2488 River Rd, Cincinnati 4, O

Super Ionic Gun Needs No Spray Booth

Electrostatic spray painting, where the paint is charged to make it fall to the oppositely charged workpieces, is done with a micro-pressure "Super-Ionic" gun that is free of rental or royalties. The unit atomizes paint particles and keeps them in constant agitation and recirculation at the head. Gun increases paint coverage, reduces paint costs, and eliminates need for high-velocity exhaust system that also loses factory heat in winter.

Scientific Electric Co, 107 Monroe St, Garfield, NJ

Automatic Control For Speed-Trol

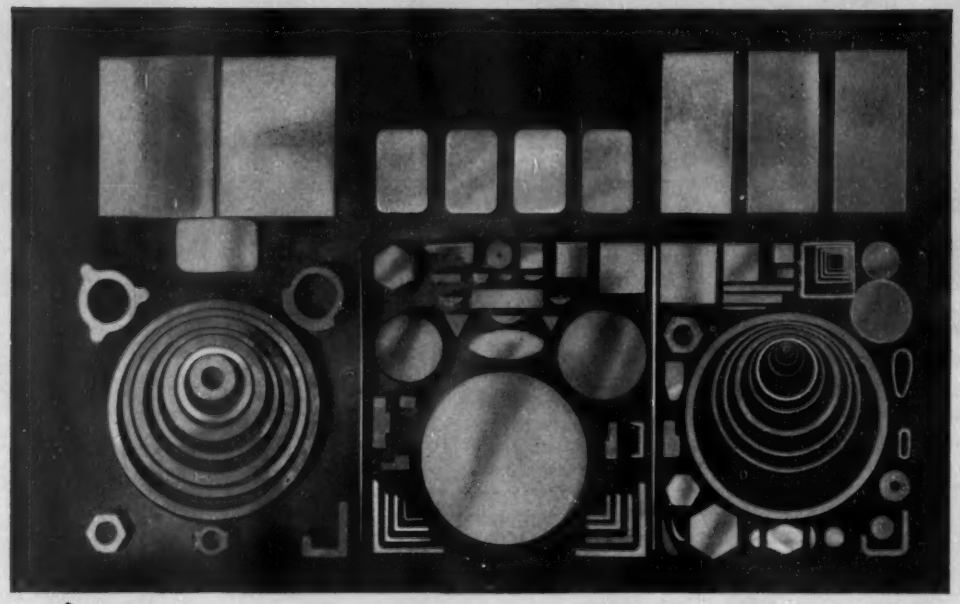
Pneumatic control for Speed-Trol variable speed transmission uses Cono motor and provides automatically controlled drive for processing operations involving variables such as pressure, temperature, liquid level, proportional flow, and control of rewind. It is available in both manual and automatic types.

The speed transmission itself embodies fingertip control, positively displaced variable-pitch-diameter pulleys, and specially designed variable-speed V-belt.

Sterling Electric Motors, Inc, 5401 Telegraph Rd, Los Angeles 22, Calif

Campbell Abrasive Cutters

International Nickel Uses CAMPBELL ABRASIVE CUTTERS for wide variety of fine cutting operations



With the exception of the strip plates and sheet stock, the pieces of Monel* shown here have been cut by International Nickel on CAMPBELL Abrasive Cut Off Machines. The largest section is approximately 10″ in diameter. These same CAMPBELL Abrasive Cutters also are valuable for fine cutting operations on stainless steel, alloy and other steels difficult to cut.

This is a **Model 480** CAMPBELL Abrasive Cutter at work in a warehouse of International Nickel. At the time this picture was taken it was cutting "K" Monel*, 4¾″ in diameter. Time of cut was two minutes. This machine has the capacity to handle material up to 8″ square (8″ x 8″).

CAMPBELL *Abrasive Cutters are available in the widest variety of styles and models—fully automatic and semi-automatic. Write for* CAMPBELL *Bulletin* **DH-301** *on the* CAMPBELL *Abrasive Cutting Method.*

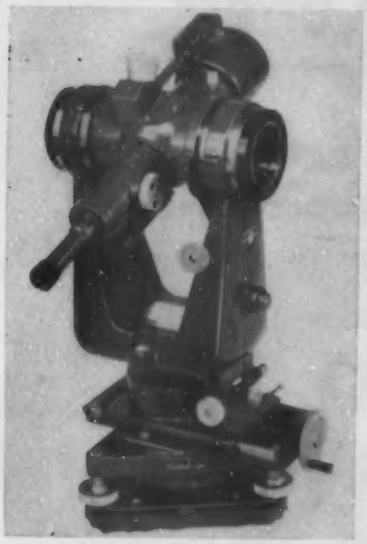
*Registered Trade Mark International Nickel Co., Inc.

Visit Booth 1228
NATIONAL METAL EXPOSITION
International Amphitheater
CHICAGO, ILL. • NOV. 1-5, 1954

ACCO

Campbell Machine Division
AMERICAN CHAIN & CABLE

923 Connecticut Avenue, Bridgeport 2, Connecticut



Optical Equipment For Higher Machine Accuracy

Microptic theolodite square checks points on a plane perpendicular to an optical line of sight which may be horizontal or inclined. Built-in micrometer allows taking readings to 0.001 in. Optical line is not disturbed by instrument set to it. Square has rigid construction for accurate adjustments and maintained accuracy.

Scale and projection unit for machine tools are universal and flexible; can be fitted with glass or metal scales direct reading to 0.005 in. or 0.001 in.

Other optical equipment includes surface micro-interferometer that measures in terms of light wavelengths. Calibration is not required, and the instrument is self-checking.

Engis Equipment Co, 431 S Dearborn St, Chicago 5

Loader Meters Small Parts

Miscellaneous small parts can be metered 100 to 5000 lb per hour to any continuous appliance through the use of variable speed drive having a 20:1 variation.

Loader can be made to distribute work evenly across full width of conveying mechanism in the appliance being fed. It will handle parts as small as 1/16 in. thickness or diameter. Standard hopper, which empties itself, holds up to 1000 lb of average size bolts.

Industrial Heating Equipment Co, 3570 Fremont Pl, Detroit 7

Automatic Hardness Tester Tests 1000 Pieces per Hour

Automatic Rockwell hardness tester is designed to check hardness of 1000 to 1200 pieces per hour. Workpieces are power-fed into unit which places them in position under penetrator. Load is applied, and hardness is indicated on dial. Photo-electric transistors pick up indication, actuating relays which classify material as too hard, too soft, or within allowable hardness range.

Also shown will be motorized hardness tester which is semi-automatic in operation. Reset is also automatic, so operator does not have to adjust pointer to zero after each test.

American Chain & Cable Co, Inc, 929 Connecticut Ave, Bridgeport 2, Conn

Welding Gloves

Gloves are tanned with special process which renders them green, but, because no dye has been used to obtain color, no "bleeding" results. Material of gloves is split cowhide, said to be extra soft and flexible.

Safety Clothing & Equipment Co, 1990 E 69th St, Cleveland, Ohio

Four Adamas Carbides For Machining Steel

Premium carbide grades have been announced:

434—Finishing cuts (min, 0.015 in.) at high temperature; originally developed for shell turning; contains four carbides for shock resistance and wear.

548—General finishing and light roughing, also for shell finishing; contains four carbides, has high wear resistance.

GG—High-tantalum grade for hot working, removing hot welding flash; for very heavy roughing.

474—Modification of GG with less strength, more wear resistance, good lubricating quality.

Adamas has also announced preformed blades for helical milling cutters, with helix formed in face and helix clearance on top of blade. Backs and bottoms are straight so they can be brazed into straight axial gash pockets.

Adamas Carbide Corp, Kenilworth, NJ

Motorists: here's proof...

Gulf's cleaner-burning, super-refined gasoline solves today's No. 1 engine problem!

This lamp is burning the "DIRTY-BURNING TAIL-END" of gasoline which GULF refines out
This lamp is burning NEW SUPER-REFINED GULF NO-NOX, the cleaner-burning super-fuel

Laboratory tests promised...

. . . these *immediate* and *lasting* benefits from this new, super-refined fuel:

More complete engine protection than from the so-called "miracle-additive" gasolines. Why? Because Gulf refines *out* the "dirty-burning tail-end" of gasoline (the No. 1 troublemaker in high-compression engines)—and then treats this new Super-Refined NO-NOX to give it a *complete range of protective properties*. It protects *every* part it touches against carbon, rust, gum.

Extra gas mileage in all your everyday, short-trip, stop-and-go driving.

No knock, no pre-ignition. Why? Because the anti-knock power of new Gulf NO-NOX has been stepped up to an all-time high.

Stall-proof smoothness. Instant *starts*, too—and fast, fuel-saving warm-up.

That's why new Super-Refined Gulf NO-NOX gives your engine more power-with-protection than you've ever known.

Road tests proved...

These cars, powered by New Gulf No-Nox, actually performed better than new... after 15,000 miles!

True! After 15,000 miles per car—covering all conditions of city and country driving—Gulf test cars showed these results:

- Higher-than-new horsepower!
- Better-than-new on gasoline mileage!
- And not a single trace of carbon knock or pre-ignition at any time—even on the steepest mountain grades!

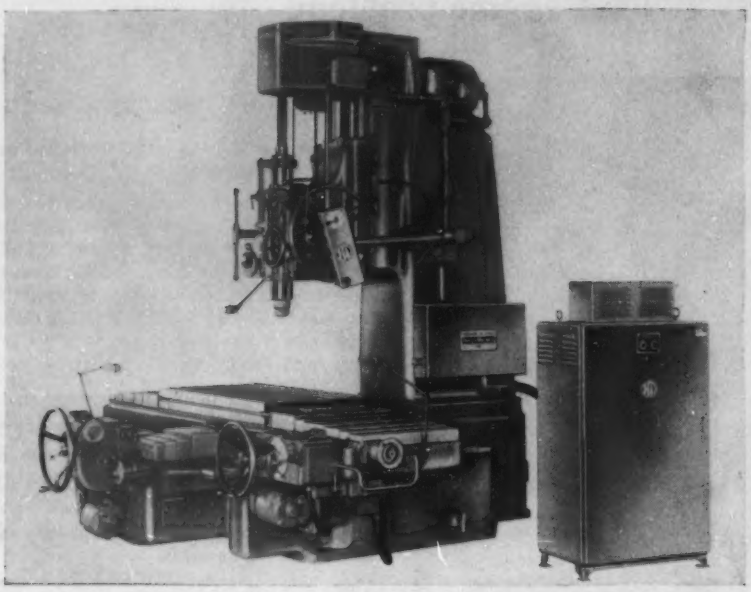
COMPLETELY NEW! SUPER-REFINED

New Gulf No-Nox

THE HIGH-EFFICIENCY GASOLINE

GULF

New Shop Equipment, Materials, and Parts...



Pratt & Whitney Adds Model 3E To Electrolimit Jig Borer Line

New jig borer, designated 3 E, has been added to the Electrolimit line of P & W jig borers. 13-ton machine, designed for locating, boring, milling, and checking, has 28 x 56-in. table. Table travel is 48 in. longitudinal, 30 in. transverse. Max height between table and spindle is 30 in. Columns 6 to 14 in. higher than standard can be furnished.

Milling feeds are controllable in infinite steps from 1 to 15 in. per min., with rapid table feed of 60 in. per min. Eight spindle feeds give range between 0.0005 and 0.015 ipr, and spindle speeds range from 30 to 1500 rpm.

Two Electrolimit measuring units are employed—one for longitudinal, the other for transverse movement. Measuring is independent of traverse screws. Each unit obtains basic 1-in. spacings electromagnetically from solid notched master bar, and registers zero reading without physical contact.

Preloaded ball-roll quill roll-feeds on precision balls loaded with total bearing pressure of 8000 lb. Vertical operation of the head assembly is controlled by push buttons, and an automatic interlocking mechanism clamps the head positively in position after motion, releasing it before motion starts.

Other details include centralized control, open-side design, automatic pressure lubrication, telescoping guards on all ways, and separate motor-control cabinet to prevent heat transfer.

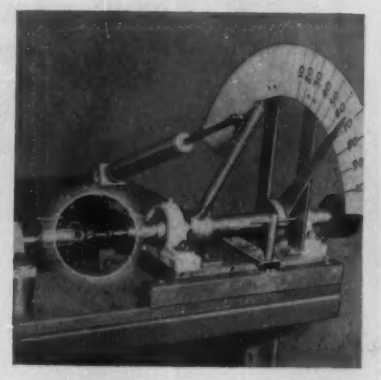
Pratt & Whitney, Div Niles-Bement-Pond Co, West Hartford, Conn

Portable Layout Machine

The Ott Locator was designed to meet the demand for a portable layout machine. Model 3A permits layout and centerdrilling of flat stock, sheet stock, die blanks, and plastic plates, square or circular. Also, centerholes may be produced at given locations without the need of drill jigs, height gage, discoloration of stock, centerpunches, or a milling machine.

Locating and center-drilling a hole becomes simple, at fingertip control, after dimensions are read and located by simple vernier scales.

C R Ott Instrument Corp, Route 10, Hanover, NJ



Impact and Wear Testing Machine For Power Screwdriver Bits

Specially designed, custom-made machine for testing impact and wear of power screwdriver bits used on production lines is now in operation to test Nutmeg bits.

Bit is inserted into a chuck longitudinally, and is then propelled into and engaged by a hardened test block that is rotated into tailstock. It is driven by a series of gears and gear boxes, simulating actual production-line conditions for wear and impact, at about 5 rpm.

Tension is applied from the test block at an absolute controlled inch-pound rate to insure known pressure of every piece tested. Bit is continually released and re-inserted in the block under a control torque pressure for a designated number of revolutions. At conclusion, bit is compared for wear and torque against acceptable standards for the Nutmeg line.

Manufacturers who would like to test screwdriver bits now in use on their production lines may do so free of charge by forwarding them to the company.

Nutmeg Screw Machine Products Co, Wolcott, Conn

Cold-Treating Units

Industrial coolers designed for freeze-treating of metals handle steel to temperatures of about –120 F. This treatment gives a positive set to the steel, especially in tools, gages, and dies, so it does not change in structure over a period of time.

Conrad, Inc, Holland, Mich

World's Smallest Air Drill...

Bill - this is that little drill I told you about! B.R.

3/16" HEAVY DUTY DRILLING

1/4" LIGHT DUTY DRILLING

NEARLY 1/4 H.P. . . . STALLPROOF

USES 38% LESS AIR

WEIGHS LESS THAN 1½ LBS.

It's Really Amazing!

Highest precision construction makes this drill revolutionary!

Write ARO or see your ARO distributor.

THE ARO EQUIPMENT CORP., BRYAN, OHIO
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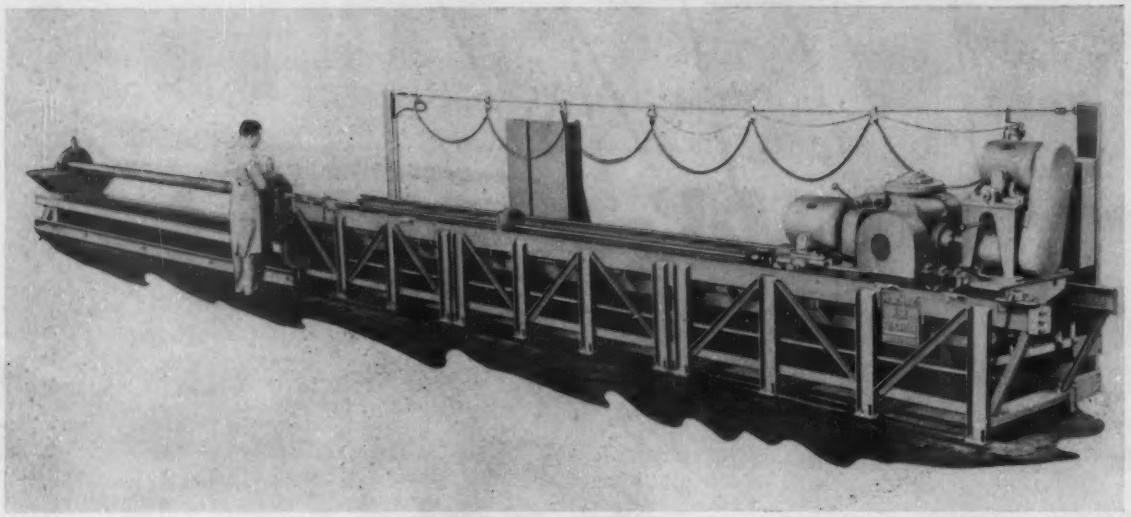


Long-Stroke Honing Machine is Lighter, Lower Cost, Simply Operated

For production honing of parts that have exceptionally long bores, here is a new series of Microhoning machines, said to have the power and speed range necessary for heavy and rapid stock removal.

Machines in this newly-created No. 6000 series are designed to stroke any length over 5 ft. The model shown (No. 6020) provides capacity for a 20-ft stroke and a diameter of 10 in. Even larger diameters are possible when shorter bores are being honed.

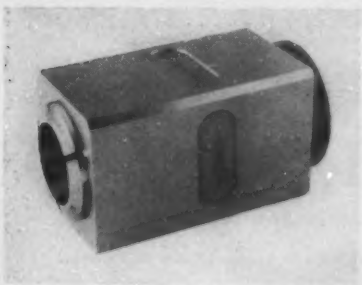
The head, powered by an electric motor which includes a clutch arrangement to permit reversing, rides on two rails and is mechanically reciprocated with a gear and rack. To reduce cost and weight, the base is of simple, channel-iron construction. There are no hydraulic connections between the head and the base of the machine.

Seven combinations of four spindle speeds provide a range from 44 to 350 rpm and the maximum reciprocating speed is 60 sfpm. Abrasive feedout and control of the finished bore size are accomplished by mechanically expanding the tool through a Hydrobrake adjusting head, regulated by the operator. To increase pressure on the abrasive, a hand lever on the head is easily operated while the machine is stroking.

At the end of, and attached to, the 31-ft-long machine proper is the fixture base.

Its design is determined by the length and shape of the work to be honed.

Micromatic Hone Corp, 8100 Schoolcraft, Detroit 4, Mich



Indexing Fixture Simplifies Setups

Brown Block Chuck has been designed for accurate 90° indexing of round stock for cutting squares, splines, keyways, flutes, special tools. The hardened and ground steel block with a precisely centered collet seat and drawnut is square and parallel within 0.0005 in.

Fixture can be used on lathes, milling machines, surface grinders, or drillpresses with a minimum of setup time. With work clamped in the collet, block is held in position by a four-jaw chuck, magnetic chuck, or vise, and flopped 90° or 180° after each cut is finished. Work need not be released from collet until job is completed.

Placing unit on a magnetic sine bar or in a universal vise enables user to index compound angles, such as are required for tapered square shanks and tapered fluting. Use in a common or magnetic V-block doubles its indexing stations, permitting octagonal indexing and other work involving increments of rotation of 45°. Economical jigs and fixtures can be designed around basic block for special angles.

M and H Products, Box 1057, Danbury, Conn

Monoflo Conveyor

Monoflo is a simple conveyor for handling light loads along paths which can incorporate both horizontal and vertical bends. Standard components, available for immediate delivery; can be quickly assembled to meet any requirement.

Basically, unit consists of flexible high-carbon-steel screw approximately ¾ in. in dia which turns in a metal retaining rail. The top of the rail is open to permit exposure of the screw. When a load-carrying hook is placed on the rail, the thread of the screw immediately engages the hook and propels it along the rail.

The Monoflo drive is a compact motor unit completely mounted, ready for installation, and is available in a full range of fixed and variable speeds.

M-H Standard Co, 515 Communipaw Ave, Jersey City 4, NJ

Time to Reduce Milling Costs!

COSTS DOWN!
PRODUCTION UP!
No. 1-8
8" table travel... 25" x 9" table... automatic hydraulic table feed.
No. 2-20DS
Double Spindle for two milling operations at same time... 20" table travel... 42" x 12" table.
No. 2-20
20" table travel... 42" x 12" table.. fully automatic hydraulic table feed.
No. 1-14DS
Double Spindle for two milling operations at same time ... 14" table travel ... 32" x 9" table.
No. 1-14
32" x 9" table ... 14" table travel ... hydraulic table feed ... full automatic cycle.
No. 1-V
Hydraulic vertical head feed ... 5¼" head travel ... 25" x 9" table.
No. 2-20V
20" table travel... vertical spindle with speed range 32 to 1284 R.P.M. ... 42" x 12" table.
No. 1-M
Hand feed to table and head ...25" x 9" table ... Adjustable head counterbalance.

KENT-OWENS REPRESENTATIVES

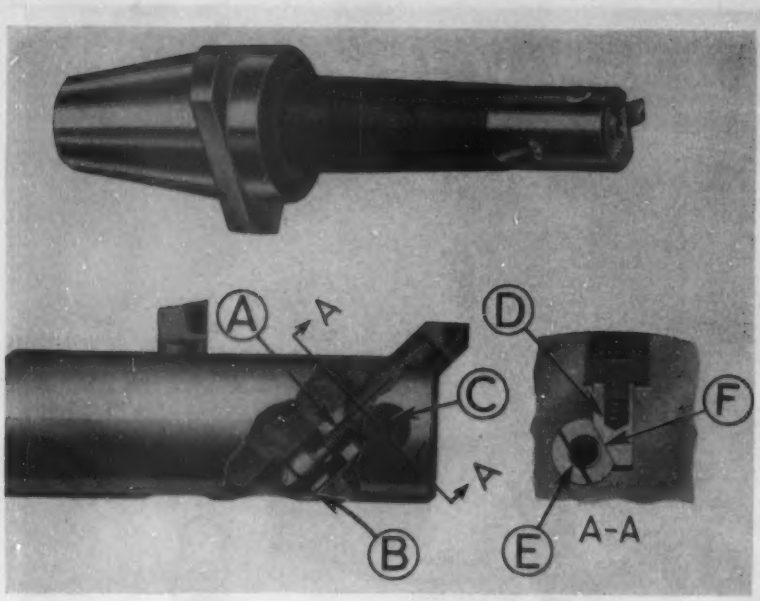
BOSTON — General Machinery Corp.
BUFFALO — Elon W. Patterson
CHICAGO — Four States Mach'y Company
DALLAS — Hantz Machine Tool Co.
DAYTON — C. H. Geesiger Mach'y Co.
DETROIT — A. C. Habenkorn Mach'y Co.
FT. WAYNE — Owen Machinery Co.
GRAND RAPIDS — Joseph Monahan
HAMILTON, ONT. — E. F. Barber Mach'y Company
HARTFORD — Harrington Machinery, Inc.
HOUSTON — Oliver H. Van Horn Co., Inc.
INDIANAPOLIS — Owen Machinery Co.
KANSAS CITY — Hickman Machinery Co.
LOS ANGELES — Gosweiler Mach'y Co.
MILWAUKEE — Four States Mach'y Company
MINNEAPOLIS — The Lamacher Company
MOLINE — John J. Normoyle Co.
MONTREAL — E. F. Barber Mach'y Co.
NEW ORLEANS — Oliver H. Van Horn Co., Inc.
NEW YORK — Harrington-Wilcox-Brown Company
PHILADELPHIA — Cohen Machinery Company
PITTSBURGH — Barney Machinery Company
ROCHESTER — F. W. Schieder Machinery Co.
SAN FRANCISCO — C. F. Bulkeley Machinery Co.
ST. LOUIS — Blackman & Nimrod Mach'y Co. Clarke Equipment Company
SYRACUSE — J. S. Owens Mach'y Company
TORONTO, ONT. — E. F. Barber Mach'y Company
WINDSOR, ONT. — E. F. Barber Mach'y Company

Kent-Owens machines assure you of speed with accuracy ... and cut your milling costs! Designed with advanced features ... performance-proved for meeting tough schedules in production milling. Rugged ... simple ... versatile. Twin-post head mounting assures balanced load. Greater cutting efficiency—only two gear contacts, motor to cutter. Write for bulletins on wide range of hydraulic and hand-operated machines. Also, let Kent-Owens design and build your tooling and special machines. Kent-Owens Machine Co., Toledo, Ohio.

Call on

KENT-OWENS

for Milling Machines



Quick Change Micrometer Boring Tool

Boring tool, designed as one of a series of "P.D.Q." brand quick-change tools, incorporates several new features.

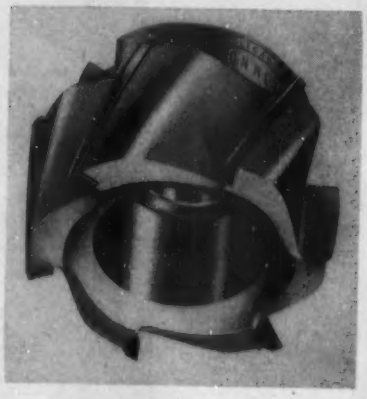
Figure A illustrates completely enclosed micrometer-adjusting screw unit; screw is protected from dirt and metal chips. Figure B shows how toolbit is positioned from a seat that is also protected and enclosed in the bar itself. Figure C is a new lock screw that releases the wedge clamp. When the clamp (see Figure D) is loosened, spring insures positive contact between wedge and toolbit, preventing turning when dial is being adjusted. Figure E shows eccentric hole in the wedge which prevents it from turning, thus allowing easier insertion of toolbit. Wedge clamp angle, Figure F, offers highest mechanical advantage in securely locking toolbit. Tool adjustment and clamping can be made from the most accessible operating position with one hand.

Portage Double Quick Tool Co, 1026 Sweitzer Ave, Akron 11, Ohio

Automatic Marker Performs Double Operations

Dual-operation screw-machine tool that performs marking and cutting off on automatics, Model 700, eliminates 2 to 3-sec. dwell normally required for swing marking. Die used for marking is segment carried clear of part after marking while cut-off tool continues its operation. Depth of marking impression is controlled by starting cam on segment die. Cam extends some distance ahead of first character, permitting variation of marking depth by adjusting point of contact of part with starting pad.

New Method Steel Stamps, Inc, 147 Joseph Campau, Detroit 7, Mich



Helical Carbide Shell-End Mills Added to Sonnet Cutter Line

True helical carbide shell-end mills, carbide-tipped over full length of flute, have been added to Sonnet Tool's line of heavy-duty, high-production milling cutters.

Longer cutting edge, 1¾ or 2 in., depending upon diameter of the cutter, enables Helicarb units to complete in a single pass shoulder cuts now requiring two or more passes with conventional cutters. Included cutting angle remains constant over full length of the carbide edge, distributing the load uniformly. Resultant shearing action is said to greatly reduce impact, chatter, and crumbling of the edge.

Cutters reportedly can remove metal three to ten times faster than HSS or straight-flute, carbide-tipped units, and produce finishes of 20 rms and better. Flute design causes chips to flow away from the work, and keeps recutting to a minimum.

Mills are available for both steel and non-ferrous applications, and may be used with standard shell-end mill adapters. Cutter diameters range from 3 to 6 in.

Sonnet Tool & Mfg Co, 576 N Prairie, Hawthorne, Calif

Moore Rotary Table Accurate to ± 6 Seconds

Model 2 Moore 11-in. rotary table has overall performance accuracy of ±6" throughout 360°. Angular spacing is accomplished by non-disengageable, thread-ground worm and mating gear. Corrective lapping is said to produce tooth-spacing accuracy within less than ±4". Lapping is measured by interferometric inspection and calibration.

Accurate in vertical or horizontal position, table is designed for applications on jig borers and jig grinders. Added vernier permits reading normally in vertical position. Scale setting is read to 5" on dial and center bushing runs true to 0.00015 in. TIR.

Specifications include 10⅞-in. dia working surface, 4½-in. height in horizontal position, vernier graduations to 5"; weight of 125 lb.

Moore Special Tool Co, Inc, 740 Union Ave, Bridgeport 7, Conn

Cleaner Gun

Kelite hand-sprayer No. 4 for dispensing the manufacturer's Spray White cleaner is equipped with two jets, spray and needle. Plastic container holds full pint with visual indication of contents.

Kelite Products, Inc, 1250 North Main St, Los Angeles 12, Calif

SAW HARD STEEL TURNED

at 450 surface feet per minute

on standard Axelson 20" heavy duty lathe

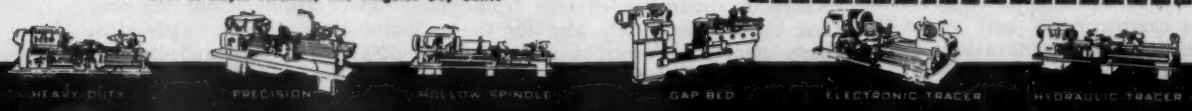
Heat treated steel forged oil tools that test 38 Rockwell C are precision turned at 450 surface feet per minute on this standard Axelson 20" heavy duty lathe. Both one-quarter inch roughing cuts and fine finishing cuts are made at this speed using Vascaloy E cutting tools and chemical coolant. The cutting tools have chip breakers ground into them and cutting edges are honed to produce better finishes and longer tool life. All turned surfaces including threads are machined to better than 40 micro inch finishes, which eliminates costly grinding operations. Tolerances of — ±.0015" are easily held.

Axelson lathes are precision built and designed to take full advantage of **high speed** cost cutting turning techniques. Standard Axelson 20" lathes now have top spindle speeds of 1288 R.P.M. Spindles are mounted on double front and rear precision timken bearings and are driven through a series of hardened and precision ground alloy steel gears that maintain a smooth flow of power to the cutting tool. Flame hardened and precision ground tool steel carriage ways preserve original accuracy and alignment year after year. These standard Axelson features provide the essential requirements for modern high speed turning. Axelson Engineering will be glad to make suggestions for your work—whatever your problem may be —without obligation.

Call on the Axelson dealer or representative in your locality or write direct to the factory at 6158 S. Boyle Avenue, Los Angeles 58, Calif.

PERFORMANCE DATA

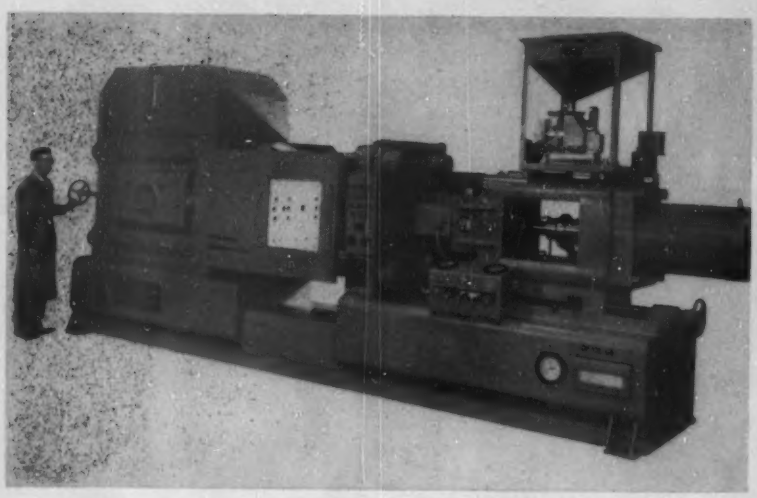
Company	Directo Corp., Houston, Texas.
Part	Drill Collar Sub—"Fluidrill" Part
Machine	Axelson 20" Heavy Duty Lathe
Number of Pieces	10 per Lot
Material	S.A.E. 4340 Heat treated
Hardness	38 Rockwell C
Depth of Cut	¼ Roughing
Greatest Precision	±.0015"
Tool Material	Vascaloy E—with special chip breaker .010" deep, .060" wide, .030" radius, cutting edge honed.
Coolant	Chemical coolant 25-1
Feed	.012" Rough, .008" Finish
Speed	287 RPM—450 S.F.M.
Floor to Floor Time	4½ hours complete
Finish	Better than 40 micro inches
Note	Threads were cut by feeding straight-in at 250 S.F.M.
Product	The Fluidrill is a revolutionary aid that will increase the speed of penetration in rotary oil well drilling of more than 25" by keeping the bi. firmly seated on bottom and cutting at all times.



AXELSON MANUFACTURING COMPANY DIVISION
PRESSED STEEL CAR COMPANY, INC.
LOS ANGELES 58, CALIFORNIA

PSC

STANDARD PARTS • DAIRY & FARM EQUIPMENT • WASTE CONTAINERS • STAINLESS STEEL COOKWARE • CAR ACCESSORIES • TANKS • AGITATORS • SMOKE STACKS • DUST COLLECTORS • COAL & ASH HOPPERS • FITTINGS & ELECTRICAL ACCESSORIES • ORDNANCE MATERIEL • UNISHELTER RELOCATABLE HOMES • EXPORT ONLY: LOCOMOTIVES & TRACKWORK CARS (MINE, ORE, CANE, INSPECTION) • UNISTRUT METAL FRAMING • WEED BURNERS • BRICK & TILE MACHINERY • CANE LOADERS



Injection Molding Machine Has 60% Higher Injection Speed

Injection molding machine in 20-28-oz range has 60% higher injection speed than previous 16-oz model. Horsepower has been raised from 30 to 50, and machine has automatic-weigh feeder to insure correct weight of granules.

Injection unit is mounted on ways, and is actuated by a single hydraulic cylinder. Unit is hydraulically retractable, and a positive sprue break can be used at operator's option.

Dual injection pump permits two-speed or dual-pressure injection. Injection pressure can be automatically reduced after cavities have been filled. Small, high-pressure axial piston pump develops clamping pressure, and high-capacity vane pump operates clamp and injection rams.

Plasticizing chamber has 3 heat zones, each pyrometer-controlled. Heater bands are mounted on spreader and heat chamber, can be dismantled for cleaning. Platen and diehead area have been enlarged. Overhead oil tank keeps oil away from contamination. Front limit-switch panel permits adjustments at front of machine. Model 400-H-20.

The Hydraulic Press Mfg Co, Mt Gilead, Ohio

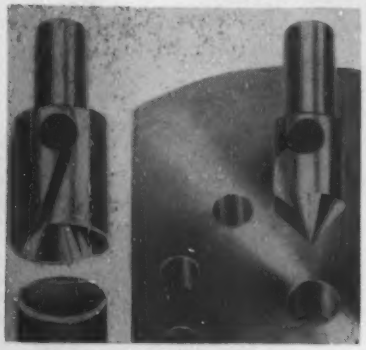
Pres-Vac Sheet Lifter Utilizes Compressed Air

Pres-Vac Lifter, primarily designed for separating and moving steel sheets, can be used on any object with a flat surface on which a vacuum can be maintained.

As long as the trigger in the pistol-grip handle is held down, suction cup will pull 11 psi. Constant, positive lifting power is produced by passing compressed air through the venturi at 45 psi, creating a constant vacuum of 22 in. of mercury. Vacuum is conveyed to the rubber cup through passages in the handle. Regulator is supplied to reduce the line pressure to 45 psi.

Unit, ready for immediate use after connecting to an airline, is supplied with a 5-in. neoprene cup, aluminum handle, 96-in. hose, and pressure regulator.

F J Littell Machine Co Air Div, 4555 Ravenswood Ave, Chicago 40



Deburring Tools

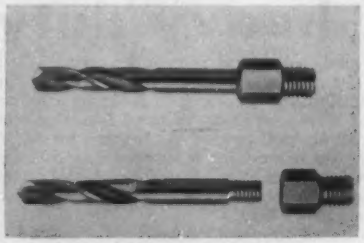
Two companion tools for deburring and chamfering of both inside and outside diameters have been added to the Nobur line.

Tools are a new design, intended to improve work quality, speed, and ease, and are hoped to improve work handling and finishing procedures.

"Nobursink" is designed for openly accessible hole faces, and "Noburod" for the outer ends of rods, tubes, and bosses. Low-torque design permits rapid off-hand work handling without chatter or development of secondary burr, even on large diameters. Controlled cutter entry prevents snagging, seizing, or excessive cutting. Both tools employ a two-piece construction, permitting cone faces to be cylindrically ground on tool and cutter grinders, or on any lathe with a toolpost grinder. Half members are then locked in a displaced position to provide automatic radial relief.

Tools can be used on all metals. Range of application extends from less than 1/16-in. hole size up to body diameter. Furnished with 90° included angle (produces a 45° chamfer); made from HSS, heat-treated and precision-ground.

Nobur Manufacturing Co, 717 N Victory Blvd, Burbank, Calif



New Drill Incorporates Adapter

Drill for use with flexible drive shafts or extension arms for making holes in narrow and inaccessible places combines adapter with a threaded-shank drill. Combination is said to eliminate runout, difficult removal of broken drill-ends, and labor.

Additional advantages claimed include space saving, since the unit is shorter than the adapter-plus-drill assembly; better concentricity with driving head; economy, because combination costs approximately the same as the old-style drill only.

National Twist Drill & Tool Co, Rochester, Mich

HY-PRO HAS SPECIALIZED TAP PRODUCTION

...to cut man-hours from your schedule

Tap production is a specialty at Hy-Pro. Our full set-up, from design engineer to shipping clerk, is concentrated toward one end—perfecting tap output and service. Over the years our proven record in the tap field has won Hy-Pro recognition among production men as "the tap specialist".

Whatever your particular needs may be—from a special tap problem to your regular set-up—it will pay to make use of our engineer specialists. They are always ready to answer your call.

We can be reached directly or through your local Hy-Pro jobber. A complete line of top quality Hy-Pro taps plus our specialist engineers can help cut man-hours from *your* production schedule.

REG. U.S. PAT. OFF.

HY-PRO

HY-PRO TOOL CO., NEW BEDFORD, MASS., U. S. A.

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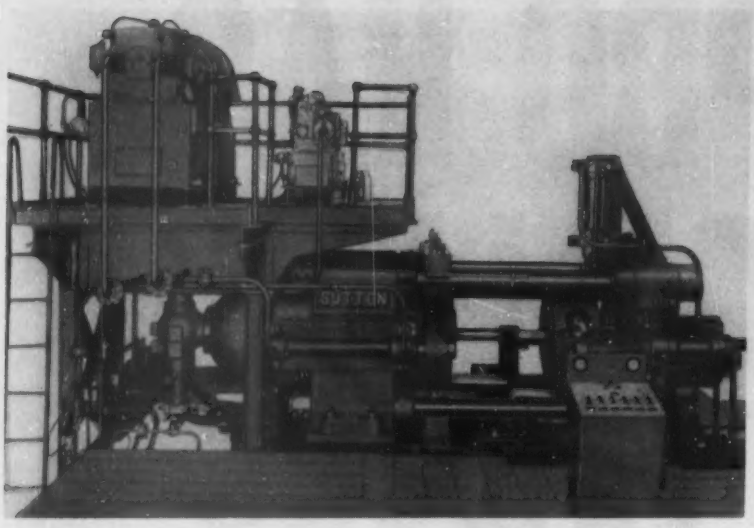
6141 NORTH ELSTON AVE. CHICAGO, ILL. NEWCASTLE 1-6486

109 EDISON PL. NEWARK 5, N.J. MARKET 2-4318

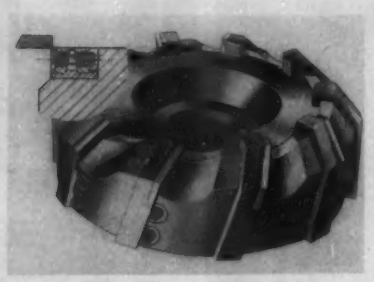


Sutton Horizontal Extrusion Press With Direct-Power 750-Ton Capacity

Horizontal, direct-powered 750-ton extrusion press is intended for nonferrous metals. Press will take preheated aluminum, brass, copper, or magnesium billet to 4 7/16-in. diameter, and extrudes solid strips, rod, and hollow or semi-hollow sections.

Press is said to incorporate extra fast cycling, positive billet loading, easy die change, heavy duty shear of high capacity, and other aids. During design, survey was conducted among users to determine what was wanted in the finished press. Resulting information has been used in manufacture of this product.

Sutton Engineering Co, Bellefonte, Penna

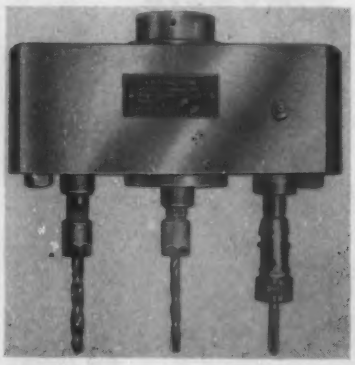


Wesson Face Mill Designed For Large Depths of Cut

Cutter series has been designed for extra heavy steel and cast-iron roughing operations where large amounts of stock must be removed in one operation.

Body is a 6145 steel forging with thicknesses from 3¼ to 3¾ in. Special 1½-in.-high replaceable Wesson-metal carbide-tipped blades, capable of ⅞-in. depth of cut, are positively locked with Wesson Dual Wedg locks. These are small, compact units with two moving wedges that lock against the blade. Wedges, actuated by a few turns of a leadscrew, are self-adjusting both axially and radially even if blade is tapered, stepped, or out of square. Large, deep gullets provide for smooth, rapid chip removal.

Wesson Co, 1220 Woodward Heights Blvd, Detroit 20, Mich

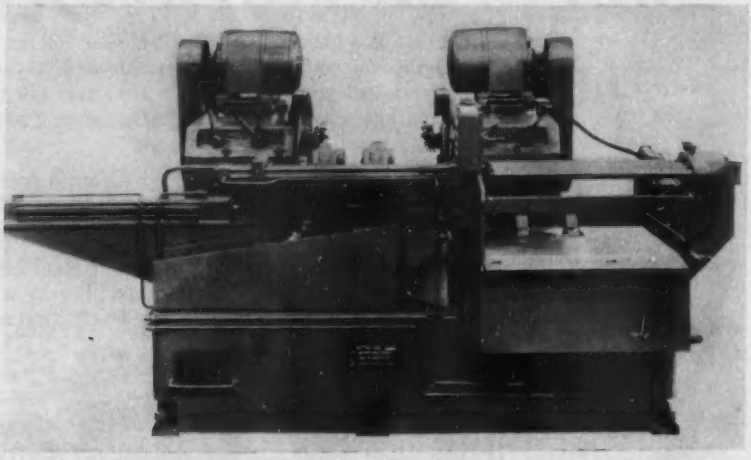


Three-Spindle Attachment Works on Drillpress

Drilling, countersinking, reaming, counterboring, and tapping may be done under one drillpress spindle with tap-drill attachment rated at maximum capacity of ¼-in. drill and 5/16-in. tap. Unit is available with 2, 3, or 4 spindles.

Work with up to a 5½-in. OD can be handled. Spindles are hardened, ground, and geared.

Errington Mechanical Laboratory, Inc, Staten Island 4, NY



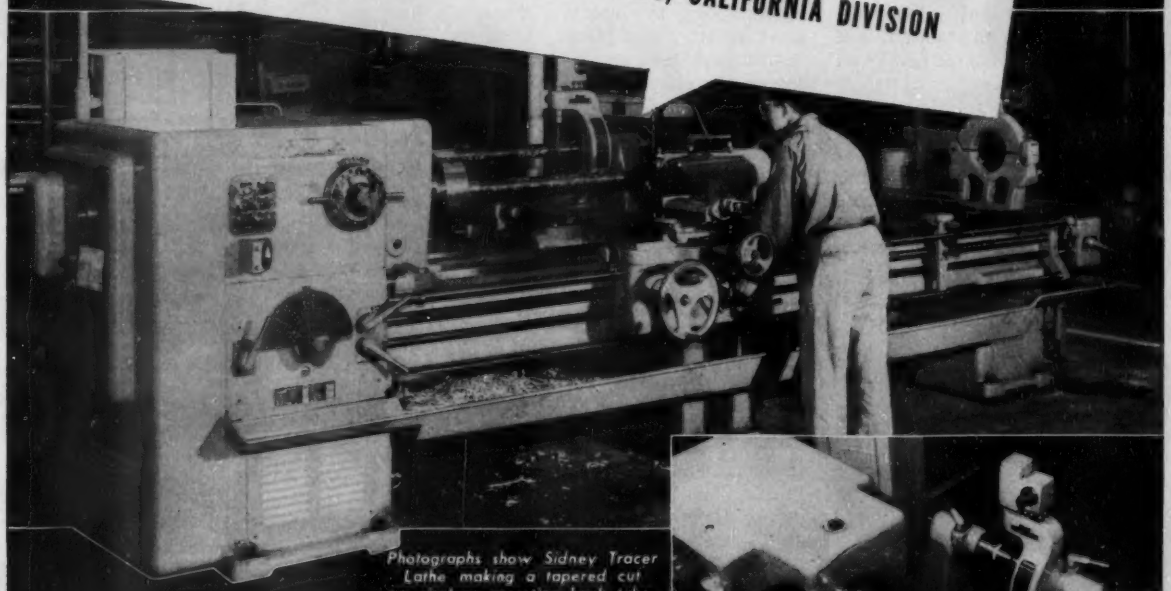
SAWING MACHINE has two heads, one RH and one LH, arranged for automatic, simultaneous cropping of both ends of an 8-in. shell forging. Heads have nine spindle speeds, multiple-disk clutch for engaging spindle drive, and self-contained lubrication system to all bearing points. Hydraulically actuated loading ram pushes shell into clamping station where it is positively located to nose of cavity by means of hydraulically operated locking rod. Overhead lever clamps secure part in machining position and rod is withdrawn from cavity. Heads then feed forward, cutting excess material from both base and nose end. After cut, heads rapid-traverse return to starting position, clamps open, and hydraulically operated unloading mechanism transfers finished shell into discharge chute—*The Motch & Merryweather Machinery Co, Penton Bldg, Cleveland 13*

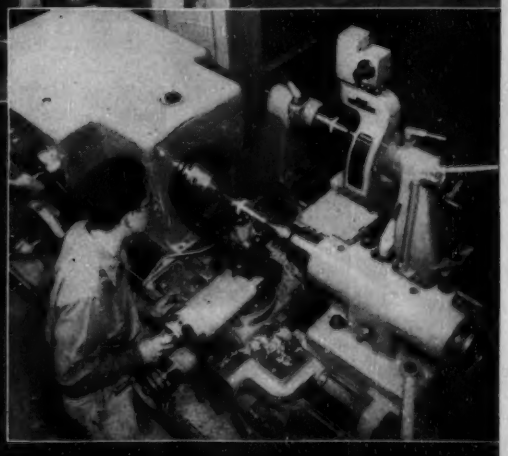
SIDNEY *can do this for you, too!*

THE SIDNEY MACHINE TOOL COMPANY
50th Year
of service to
AMERICAN INDUSTRY
1904 - 1954
SIDNEY • OHIO

"EXPERIENCE WITH THE SIDNEY 20" TRACING LATHE IN DEPARTMENT B6-406 OF THE DOUGLAS EL SEGUNDO, CALIFORNIA DIVISION INDICATES A CONSIDERABLY IMPROVED PRODUCTION CAPACITY. THE TRACING LATHE WE ARE OPERATING ELIMINATES HUMAN ERROR AS FAR AS LINEAL DIMENSIONS ARE CONCERNED."

DOUGLAS AIRCRAFT CO., INC.
EL SEGUNDO, CALIFORNIA DIVISION





Photographs show Sidney Tracer Lathe making a tapered cut on airplane arresting hook tube.

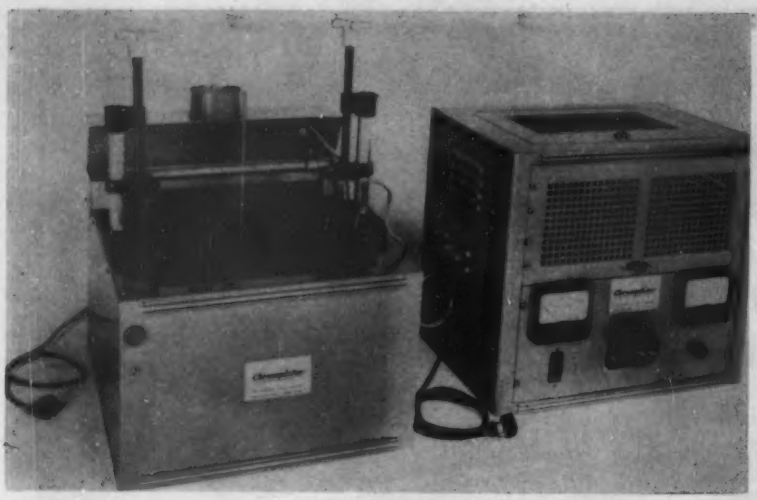
The tracer head pictured . . . the "brains" of the tracer . . . imparts all impulses to the various operating units as it follows along a template or master piece relating to these units their necessary functions in order to produce the work at hand.

One piece or a million . . . it's all the same to the Sidney Tracer Lathe . . . and all the work pieces are the same . . . every time.

WRITE FOR BULLETINS

THE SIDNEY MACHINE TOOL CO. • SIDNEY, OHIO

Builders of Precision Machinery since 1904



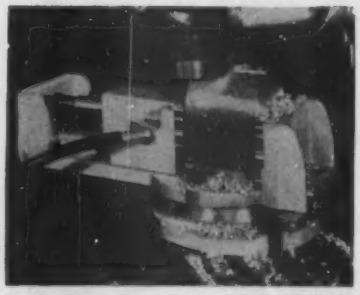
Hard-Chrome Plating Unit For Tools and Small Parts

Model 75 Chromplater is designed for a wide range of applications with smaller components and tools. It will deposit as fast as 0.002 in. per hr on areas up to 25 sq in.

Improved plating solution eliminates necessity of bath adjustment or maintenance throughout life of solution. Newly-designed rectifier embodies all necessary plating controls. Unit also includes a powerstat to control rate; a reversing switch for stripping; a voltmeter and ammeter. May be operated from a standard 110-v 60-c power source.

Additional features: a 13x13x11-in. deep tank; exhaust hood; adjustable work platform; thermostatically controlled electric heater to maintain plating bath at most efficient temperature. All types of metal may be plated.

The Dawson Corp, 302 Fifth Ave, North Pelham, NY



Automatic Machine Vise Combines Compressed Air, Hydraulic Fluid

WiltOmatic M-M air-powered hydraulic milling machine vise combines speed of an air vise with the strength, compactness, and locking force of hydraulic unit. Reportedly cuts loading and unloading time by as much as 80%, and eliminates expensive special production tooling when used as an automatic holding fixture with specially formed jaws.

Toe pressure on air valve places a force of 9000 lb on jaws, yet tool is completely flexible, adjusts with ordinary crank handle motion to any desired opening, and can be locked manually as well as under power.

Normal airline pressure of 90 lb is recommended, although unit functions on any pressure from 20 to 140 psi. Model with 6-in. jaws by 6¼-in. opening sells for $224 without swivel base, and $296 with base.

Wilton Tool Mfg Co, 925-941 Wrightwood Ave, Chicago 14

Twelve-Purpose Stamp

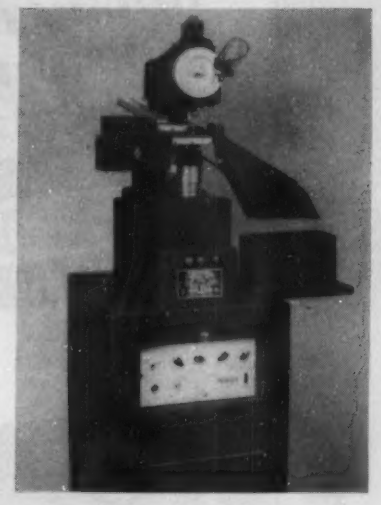
Daily Dozen hand stamp incorporates: Via Air Mail, Printed Matter, Please Rerait, Special Delivery, Hand Stamp Only, First Class Mail, Air Parcel Post, Special Handling, Do Not Bend, Registered, For Deposit Only, and Contents Merchandise: May Be Opened For Postal Inspection.

Each stamp is 1½ in. long, rubber, and selected by turning dial. Price is $1.98.

Coxeman Stamp Co, 6612 Sunset Blvd, Hollywood 28, Calif

Peel Filmite is a flame-proof spray booth coating said to give excellent adherence to metal surfaces and to provide for greater paint loads and coverage. An average of 17 minutes is required for complete cleaning job of an average size booth. Product is sprayed on with regular equipment; booth dries in minutes.

The DuBois Co, 1120-40 West Front St, Cincinnati 3, Ohio



Rockwell Hardness Tester Is Fully Automatic

Fully automatic Rockwell hardness tester is capable of performing between 1000-1200 tests per hour. Manual testers average 200-400 tests in the same period.

Pieces are power-fed into the tester and automatically placed in position beneath a diamond penetrator. Testing loads which force the diamond into the material are applied and removed; hardness is indicated on a dial. Minute photo-electric transistors pick up this hardness indication, transferring the reading to impulses, which actuate relays; these in turn classify material being tested according to correct hardness. Work may then be distributed for further processing or use, or returned for salvage or reprocessing.

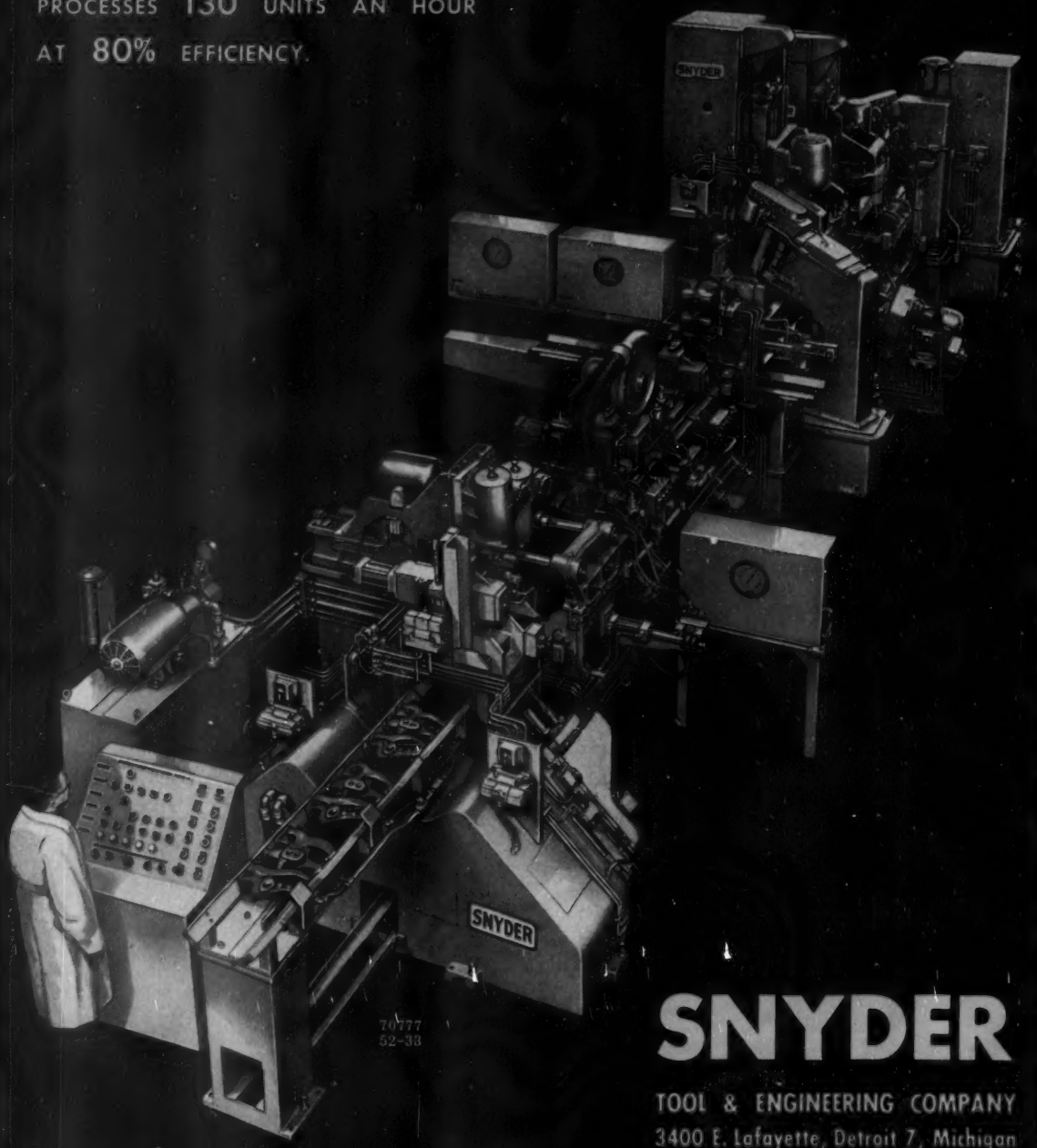
A control regulates up and down travel of the elevating screw, so that it is not necessary to have the pieces all the same thickness for testing. Additional control is available to limit dwell at end of travel of the elevating screw.

Classifying is done by means of photo-electric units mounted on bezel rings of the dial gage. These units may be set so that hardness limits as close as two points may be controlled.

Wilson Mechanical Instrument Div, American Chain & Cable Co, 230 Park Ave, New York 17

SNYDER SPECIAL 21-STATION AUTOMATIC LINE

TRANSFER MILLS, DRILLS, CORE-DRILLS, REAMS AND TAPS INTAKE MANIFOLDS; TESTS MANIFOLD FOR AIR LEAKAGE AND VOLUMETRIC AIR FLOW; INSPECTS PROCESSING PROGRESSIVELY, MARKS REJECTS; INSERTS HEATER TUBES; PROCESSES 130 UNITS AN HOUR AT 80% EFFICIENCY.

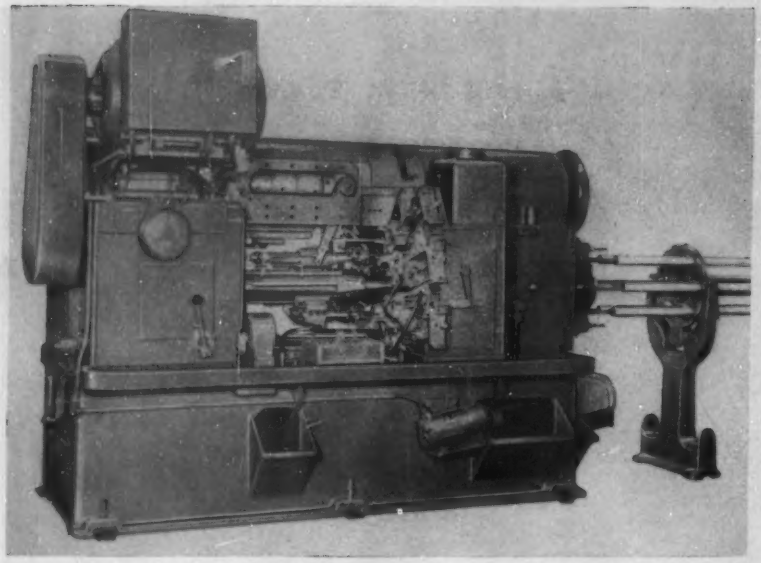


SNYDER

TOOL & ENGINEERING COMPANY

3400 E. Lafayette, Detroit 7, Michigan

29 Years of Successful Cooperation with Leading American Industries



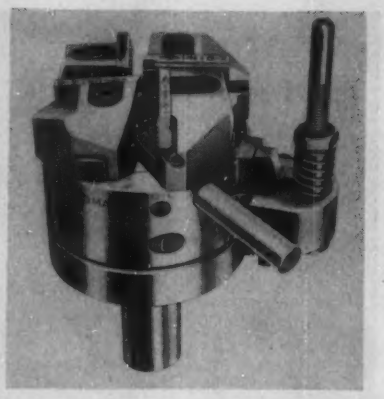
Six-Spindle Bar Machine Now in 1⅝-in. Model

Cone has announced the 1⅝-in. model TF, the eleventh machine in its six-spindle Conomatic bar machine line. The new design has more rugged construction with 3¼-in. work center clearance; 2.5 sec minimum work cycle (5 min maximum); two-train spindle-speed range with available pairs of pick-off change gears to provide 31 speeds from 128 to 2502 rpm.

Incorporated is provision for calibrated dial adjustment of the six independently actuated main cross slides, main end slide, and opposed tool spindles without change of total stroke. Also provided is an open-end attachment spindle drive with independent speeds to opposed tool spindles mounted in any position of the main tool slide. Adjustable and interchangeable heads for opposed tool spindles eliminate boring to alignment on machine.

Swing-type adjustable stock stop has coarse and fine threads. There is complete interchange provision for flat, dovetail, and circular form toolholders. Standard mechanical stop-feed length is 6 in. A two-base stock reel relieves load of extra length bar stock up to 20 ft, with lateral and vertical adjustment of stock tube disks.

Cone Automatic Machine Co, Inc, Windsor, Vt



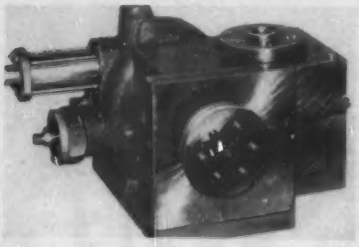
Tangential Chaser Die Head For Brown & Sharpe Automatics

Landis Machine has developed a ½-in. EXX Landmatic head for application to Nos. 0, 0G, 2, and 2G Brown & Sharpe automatic screw machines.

Although compactly designed, the die head incorporates durable tangential chasers, and a range coverage from No. 4 to ½ in. inclusive. Unlimited thread length is available for work under ⅜ in. in dia, while a maximum of 1-13/16-in. thread length can be obtained on larger work.

Unit is designed with a floating shank with adjustable spring tension to provide a means by which lead of feed cam may be compensated for in varying degrees. Die head is always able to start threading operation with amount of pressure suitable for thread pitch being produced.

Landis Machine Co, Waynesboro, Pa



Indexer for Operations Requiring Many Positions

Erickson multiple position indexer No. 477 is designed to accurately index up to 500 positions depending on gear ratio and index plate ordered. Original two minutes accuracy is proportionately reduced by the gear ratio.

Self-contained shock control unit for positive, fast indexing, can be adjusted to meet varying loads, permitting maximum speed to be used without injury to mechanism or work. Over-ride is said to be completely eliminated. Gear box turns on spindle so that model can be installed in four different positions for convenient work location. Operation is either by air or hydraulics. Drive spindle has a flange for convenient mounting of workholding fixtures. The hardened and ground index lock pin operates independently of actuating fluid.

Erickson Tool Co, 23rd & Hamilton, Cleveland 14, Ohio

Drilling Spindles for Small Hole Work

High-speed spindle unit is complete with self-contained motor for use with special drilling, reaming, and grinding machines. Speed ranges of 1000 to 10,000 rpm, or 2,500 to 15,000 rpm are available. Electric governor keeps spindlle speed constant whether idling or drilling. Precision tolerances are held throughout. Unit can be mounted in any position.

Manufacturer has also added multiple-spindle base for use with its 8-in. drillpress and for mounting two air feed drilling units in opposed position.

Drilling motors are for use in special drilling machines which have their own feed mechanisms. Units should be mounted in split boss which clamps lower quill. They can be mounted in any position.

The Electro-Mechano Co, 261 E Erie St, Milwaukee, Wis

Look into
REVERE EXTRUDED SHAPES
—it may pay you as it did Westinghouse

When engineers of the Westinghouse Electric Corporation, East Pittsburgh, Pa., designed an inner-cooled generator rotor, the problem of making the hollow rotor coils arose. It was decided to make these out of two channel sections, butted together. Such channels could be made by milling solid copper bar, but Westinghouse knew how expensive such a process is. Could Revere produce the channels by the extrusion process? We thought we could, and after close collaboration with Westinghouse engineers, the various design and extrusion requirements were finalized. The channels are extruded, drawn, annealed, and then given a final draw.

Generators containing these special rotors are cooled by forcing hydrogen through the inner-cooled conductors at 30 psig. Because the heat is picked up directly from the copper, cooling performance is greatly increased over former designs. As a result, generator output can be approximately doubled without increasing physical size. To put it in other ways, output is increased per pound of generator weight and per pound of fuel.

Extruded shapes can save a great deal of machining time and money, and make new ideas commercially practical. Come to Revere for them in copper and its alloys and aluminum alloys.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

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SEE "MEET THE PRESS" ON NBC TELEVISION, SUNDAYS

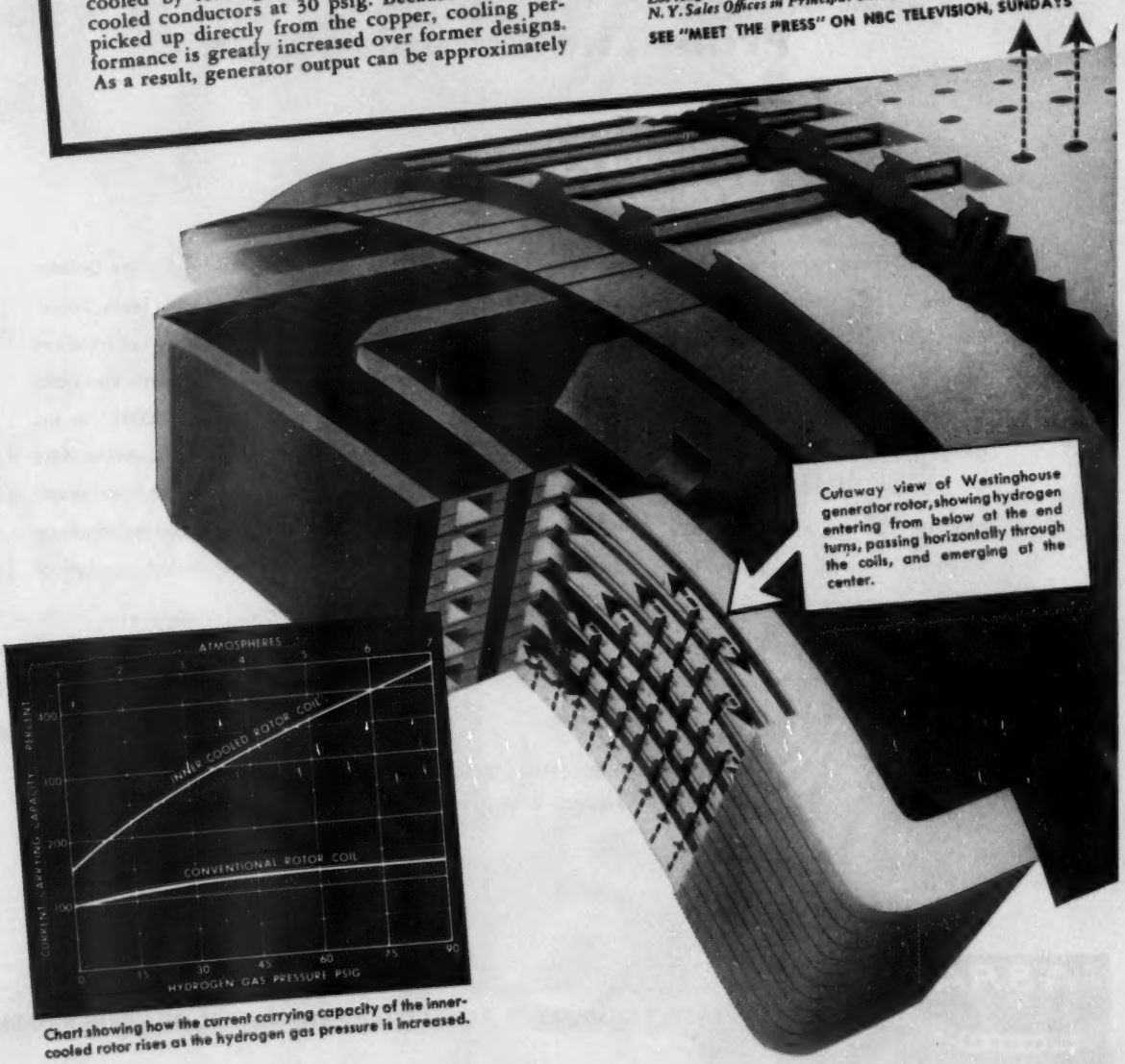

Cutaway view of Westinghouse generator rotor, showing hydrogen entering from below at the end turns, passing horizontally through the coils, and emerging at the center.

Chart showing how the current carrying capacity of the inner-cooled rotor rises as the hydrogen gas pressure is increased.

TWO GREAT GRINDERS

From The Abrasive Line

EACH of these high-speed, high-accuracy Abrasive Surface Grinders is the leader in its field. The *Abrasive No. 1½* hand feed grinder is the toolroom favorite. The *No. 1218 Hydrabrasive Surface Grinder* is "tops" for production and high-output gauge grinding.

Features of Abrasive No. 1½ include: big capacity (15" long x 10" wide x 12" high); utmost simplicity for quick set-up and fast production of short-run jobs; unit bed construction for maximum stability; conveniently located handwheels; optional location of elevating handwheel on either left or right side of wheelhead.

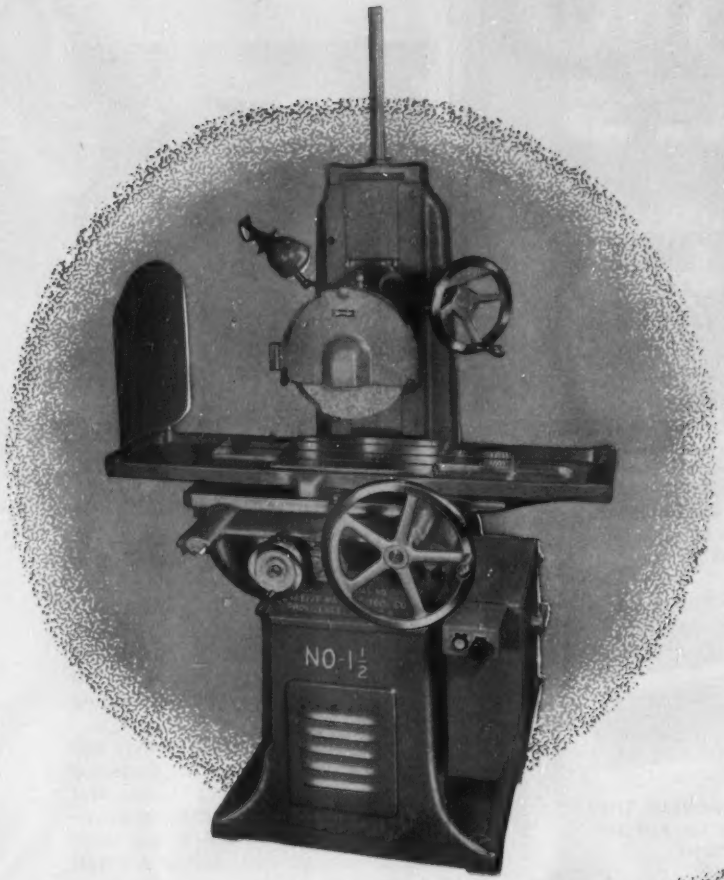
The No. 1218 Hydrabrasive Surface Grinder provides: hydraulic, high-speed table feeds, adjustable from ½ to 90 ft. per min. with ⅜" of crossfeed in ⅕th of a second; special backlash eliminator which assures that a movement of .0001" on the crossfeed handwheel equals .0001" movement of the saddle; unitized design of hydraulic and mechanical components for easy accessibility and maintenance; conveniently located electrical control panel which fully meets J.I.C. codes.

We will gladly send you complete details on both of these modern surface grinders. Write for illustrated catalogs.

ABRASIVE MACHINE TOOL COMPANY
8 Dunellen Road, East Providence 14, R. I.

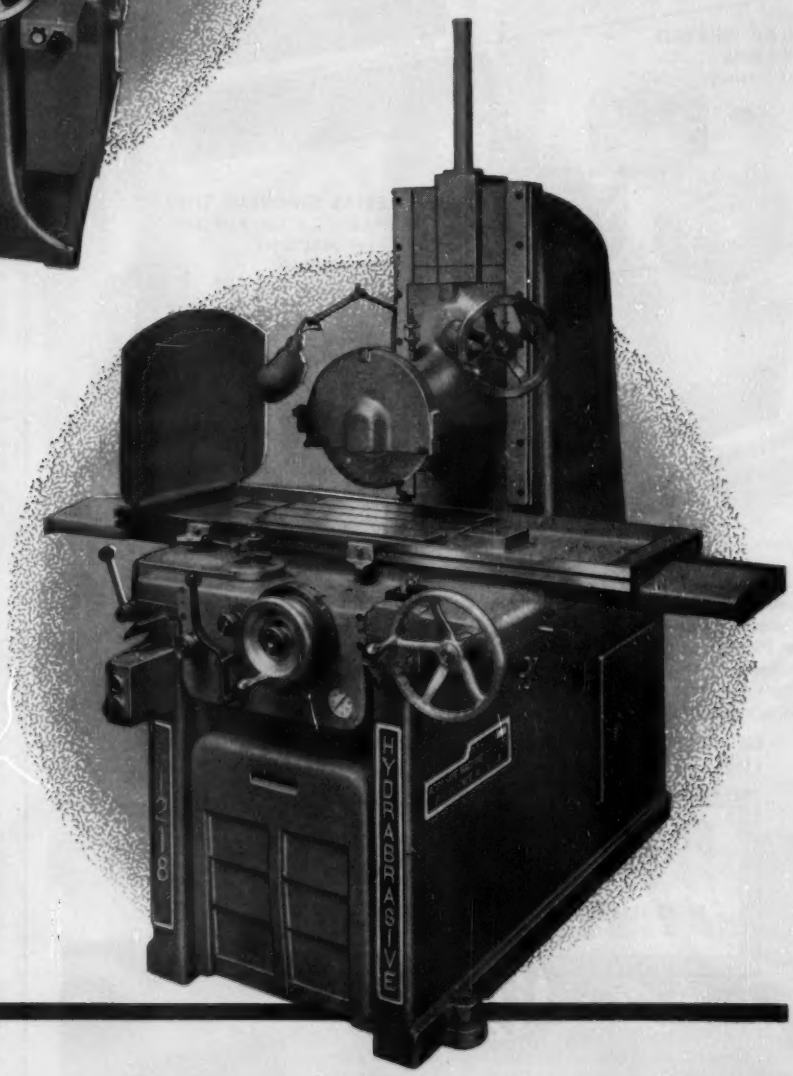
ABRASIVE
ACCURACY BOOSTS PRODUCTION

ABRASIVE QUALITY IS REFLECTED IN THE FINISH OF YOUR PRODUCT ■



- **Abrasive No. 1½ Hand feed Surface Grinder — table work area 10" x 15" — nearly 50% more work surface than any comparable hand feed grinder.**

- **No. 1218 Hydrabrasive Surface Grinder — wide cross-travel (12") and moderate table length (18"). A great grinder wherever precision transverse adjustment is required — in the manufacture of gauges, dies, fine instruments, and other high quality grinding applications.**



OTHER ABRASIVE PRODUCTS:

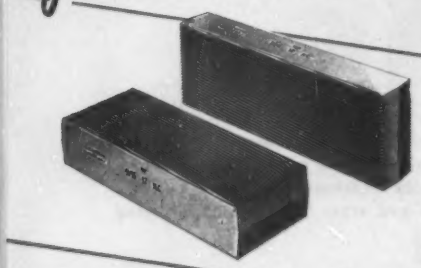
- **No. 3B Horizontal Spindle Surface Grinders**
- **No. M34 Vertical Spindle Surface Grinders**
- **18" Face Grinder**
- **No. M3 Motorized Spindle Surface Grinder**
- **No. 5 AWF Internal Finisher**
- **Model GC Circular Graduating Machine**
- **Accessories for wet or dry grinding**

THREAD ROLLING DIES

by

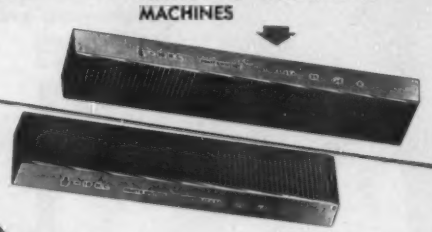
PRATT & WHITNEY

for clean-smooth-accurate threads



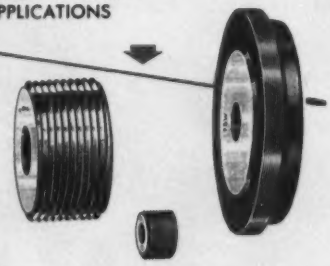
DUPLEX* DIES . . . for WATERBURY-FARRELL, MANVILLE and HARTFORD SPECIAL MACHINES
*Double faced for longer life

SINGLE FACE DIES . . . for NATIONAL BOLTMAKER MACHINES

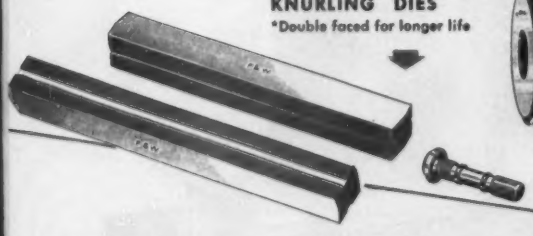


CIRCULAR THREAD ROLLING DIES . . . for REED MACHINES

SPECIAL CIRCULAR THREAD ROLLS . . . for AUTOMATIC SCREW MACHINE APPLICATIONS



DUPLEX* SPECIAL KNURLING DIES
*Double faced for longer life



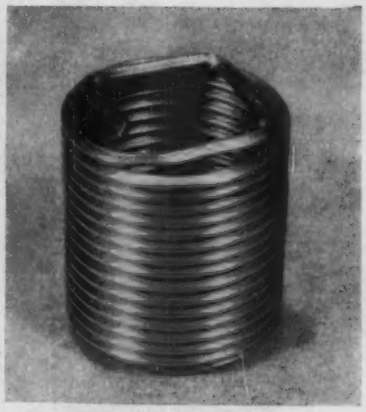
For greater die life; longer production runs without interruption; and consistently more accurate, more uniform bolts, screws, studs and similar threaded parts . . . choose P&W Thread Rolling dies. Made of special analysis high-alloy tool steel, and milled with properly compensated precision thread hobs, these dies produce American National or Unified Threads in materials ranging from nonferrous metals to tough alloy steels.

FOR MORE COMPLETE INFORMATION, ASK THE PRATT & WHITNEY BRANCH OFFICE NEAREST YOU, OR WRITE DIRECT TO WEST HARTFORD.

PRATT & WHITNEY
DIVISION NILES-BEMENT-POND COMPANY
WEST HARTFORD 1, CONNECTICUT, U. S. A.
SINCE 1860

First Choice P&W *for Accuracy*

MACHINE TOOLS • CUTTING TOOLS • GAGES



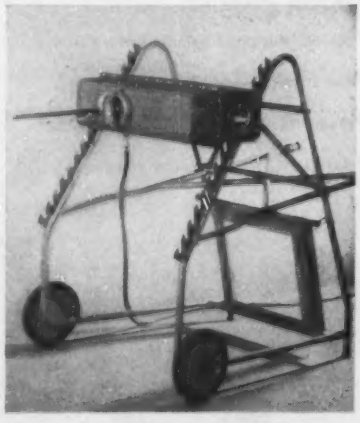
Stainless Steel Screw Insert Guards Against Vibration

Locking fastener is companion to Heli-Coil inserts, but is designed to protect assemblies from vibratory stresses and consequent loosening of screws. Insert can be incorporated into "frozen" designs because it requires no more boss material or wall thickness than conventional tapped thread.

Constricting area in bottom coil grips screw which is then protected from becoming shaken loose. But screw can be removed by approximately the same torque as was needed for installation. Meets AN-N5B specs and similar government requirements for high-temp operation. Material is 18-8 stainless wire.

Inserts do not require locknuts, so generally assembly can be made lighter and less expensive, by shortening screw lengths and locknuts. Can be used with either ferrous or non-ferrous materials. Can be inserted with power tools.

Heli-Coil Corp, Danbury, Conn



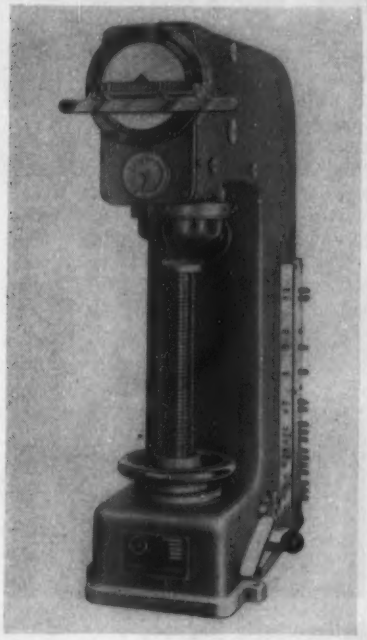
Portable Radiograph Inspects 2¾-in. Steel

An intensifier screen used with Baltograph 200 X-ray unit permits inspect-

ing steel 2¾ in. thick; thinner stock may be checked without the screen. Unit has rubber-tired carriage and accessory package as sold.

Unit is rated at 195 KVP, 5 ma, and operated from 230-volt current. Relays and meters are ruggedized and hermetically sealed, and controls are simple. The rig may be moved anywhere in the shop, and can even be moved into a boiler through a manhole, if necessary.

Balteau Electric Corp, New & Meadow Sts, Stamford, Conn



Screen-Magnified Indentations Aid Use Of Hardness Tester

Indentations produced in tests for Vickers, Knoop, Grodzinski, and Brinell hardness tests are projected on ground glass screen by Zeiss optical system. Standard Rockwell units are shown on indicator dial with automatic zero.

Reflex hardness testing machines have test load selected by pushbutton control with operating levers at right of base of machine. Vertical capacity is 12 in.

Gries Industries, Inc, 125 Beechwood Ave, New Rochelle, NY

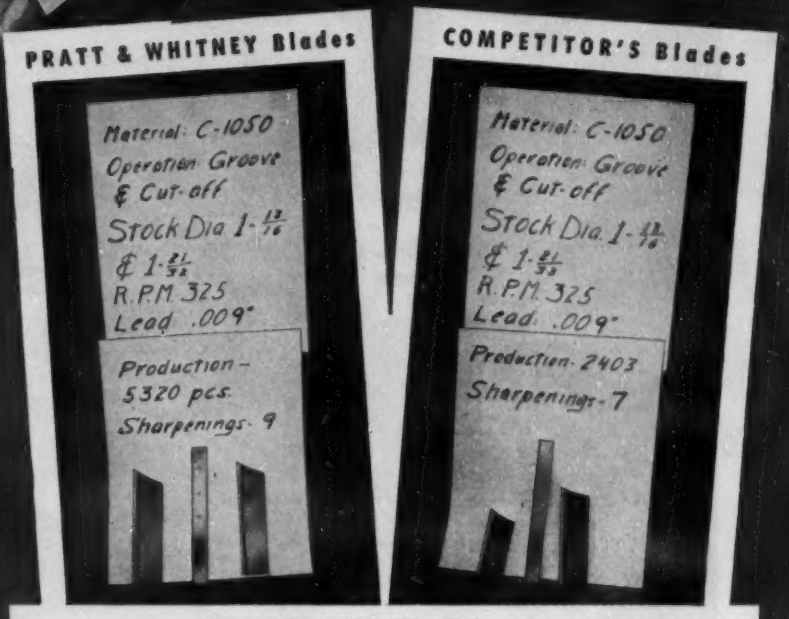
Delta-Flo fin design, said to improve efficiency of extended heat transfer surface, is being used on Trane heating and cooling coils. Delta ridge increases air turbulence over entire fin surface, reducing insulating film of dead air present on some flat fin types. Details contained in Bulletin DS-385.

The Trane Co, La Crosse, Wis

HERE'S PROOF OF THE SUPERIORITY OF

PRATT & WHITNEY

T-CUT BLADES



UNSOLICITED PHOTOS FROM USER.

HERE ARE THE FACTS . . .

One of the high-volume operations of a large manufacturer of oil-well and structural steel equipment is cutting off 1-13/16" bar stock, C-1050 steel. The Six-Spindle Automatic is running at 325 rpm with a feed of .009" per revolution. Competitive blades averaged only 2403 pieces with only 343 pieces per sharpening. P&W T-Cut Blades . . . with their superior ability to resist burning and wear . . . produced 5320 pieces with 591 pieces per sharpening . . . and are considerably longer after 9 grinds than the competitive blades were after only 7 grinds. In addition, blade breakage has been reduced to a minimum.

In this example, Pratt & Whitney Blades delivered nearly twice the work pieces per grind; resulting in a very satisfactory reduction in tool costs. The wide experience of P&W is available to you, and a factory-direct Sales Engineer . . . working from a near-by Branch Office . . . will be pleased to help in your particular application.

First Choice P&W *for Accuracy*

PRATT & WHITNEY

DIVISION NILES-BEMENT-POND COMPANY

11 Charter Oak Blvd., West Hartford, Connecticut

Please send my copy of Circular No. 561 featuring "Pratt & Whitney Cutting-Off Blades".

NAME_____

POSITION_____

COMPANY_____

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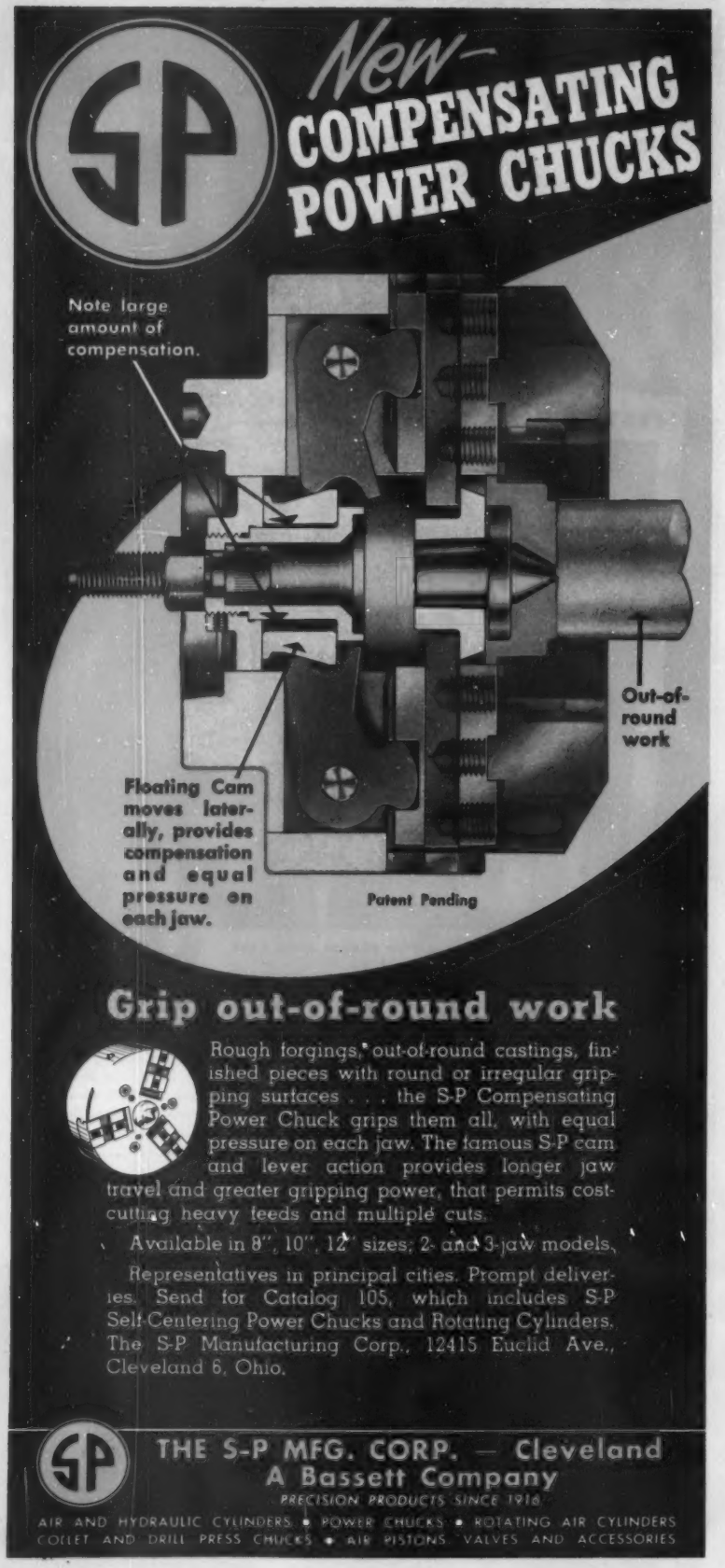
MACHINE TOOLS • CUTTING TOOLS • GAGES


SP
New—
COMPENSATING
POWER CHUCKS
Note large amount of compensation.
Out-of-round work
Floating Cam moves laterally, provides compensation and equal pressure on each jaw.
Patent Pending
Grip out-of-round work
Rough forgings, out-of-round castings, finished pieces with round or irregular gripping surfaces . . . the S-P Compensating Power Chuck grips them all, with equal pressure on each jaw. The famous S-P cam and lever action provides longer jaw travel and greater gripping power, that permits cost-cutting heavy feeds and multiple cuts.
Available in 8", 10", 12" sizes; 2- and 3-jaw models.
Representatives in principal cities. Prompt deliveries. Send for Catalog 105, which includes S-P Self-Centering Power Chucks and Rotating Cylinders. The S-P Manufacturing Corp., 12415 Euclid Ave., Cleveland 6, Ohio.
SP
THE S-P MFG. CORP. — Cleveland
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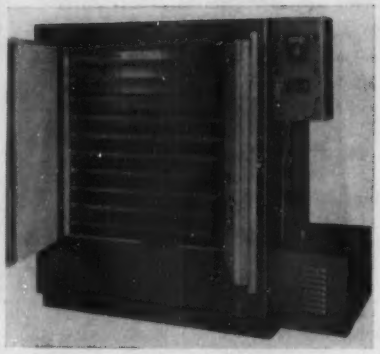
AIR AND HYDRAULIC CYLINDERS • POWER CHUCKS • ROTATING AIR CYLINDERS
COLLET AND DRILL PRESS CHUCKS • AIR PISTONS, VALVES AND ACCESSORIES

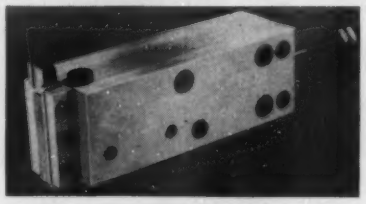


Electric Recirculating Oven

New Huppert oven can be built in a large number of sizes. Unit is designed for a maximum temperature of 650 F. Open type elements are located in the bottom, and air is recirculated by one or two stainless steel blowers, depending upon the size. Motor to drive blowers is installed in an easily accessible, ventilated cabinet.

Can be furnished with any type of temperature control desired; illustrated is the mercury-actuated form.

K H Huppert Co, 6830-32 Cottage Grove Ave, Chicago 37



Relievomatic Reduces Product Marking

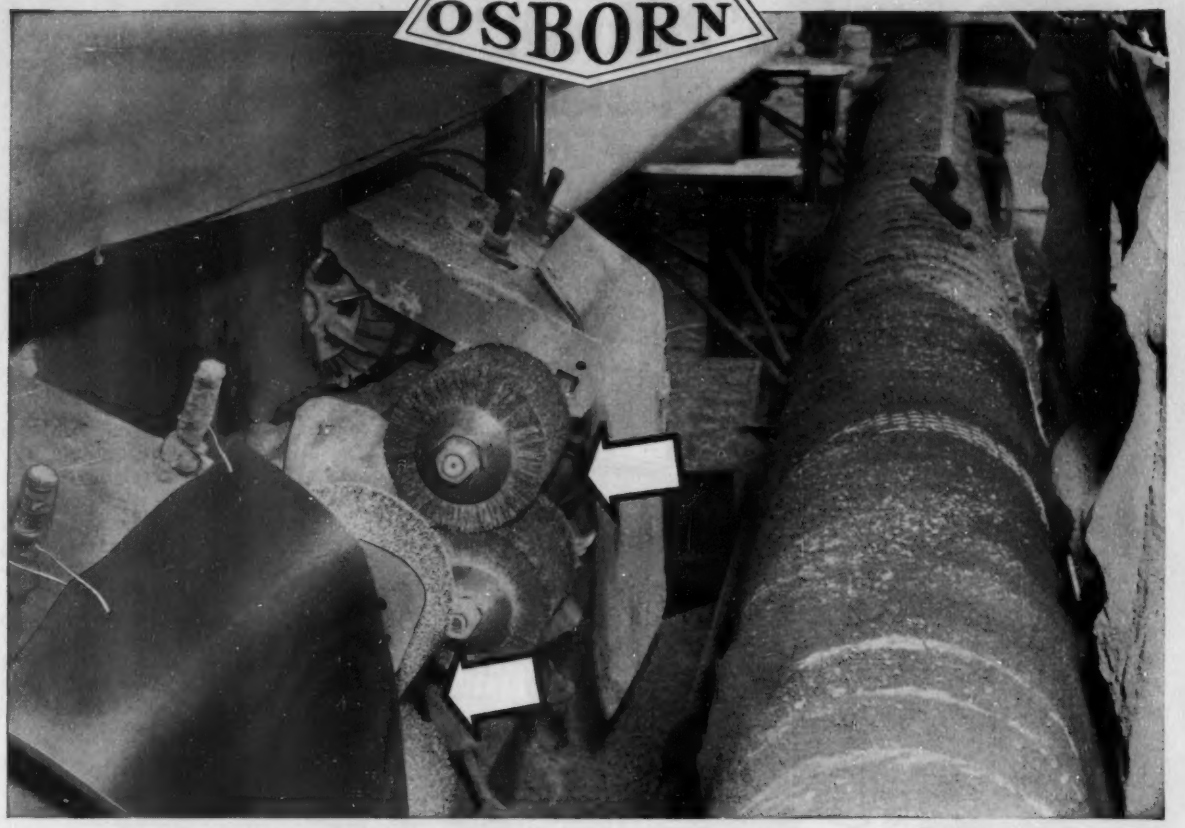
Self-relieving action adjustable up to 0.010 in. by means of a setscrew and check nut prevents tool from gouging or scratching work on screw machines, lathes, and other machine tools. Working mechanism, which is completely enclosed, has no cams, coil springs, rocker arms, or other parts likely to go out of order. Unit may be mounted on upper or lower face of machine tool.

Silber Products, Inc, 132 Lafayette St, New York 13

A 5½-in.-dia shaded-pole motor, KSP-39, is designed for heavier duty, increased efficiency and low input current. Available in ratings of 1/12, 1/10, 1/8, and 1/6 hp. Optional features include internal baffling, single- and double-shaft models, and resilient-base, cushion-ring, or shaft-end mounting.

General Electric Co, Schenectady 5, NY

OSBORN



Triples brush life

CAN AN OBA CUT YOUR COSTS?

Master of many jobs. *Because it can do so many different jobs, the Master Wheel is one of Osborn's most popular wire brush wheels. It is used extensively for finishing, cleaning, burr and scale removal. Here, it is being used at 3000 rpm to remove scale from a heat-treated part.*

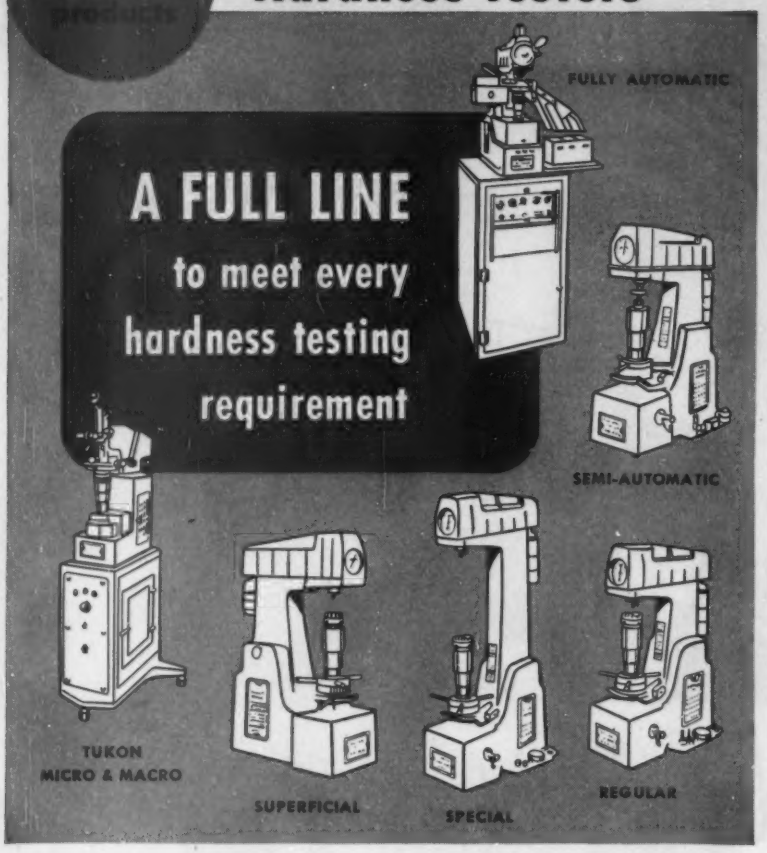
THE wire brush wheels formerly used for coating this pipe with concrete lasted a maximum of 115 pipe lengths. Now, Osborn Master® Wheels coat 350 pipe lengths—a 3 to 1 superiority in service life. Longer brush life is typical of results obtained by an **O**sborn **B**rushing **A**nalysis.

Whether your operation is a special job like coating concrete . . . or any cleaning, finishing or burr removal applications, an **OBA** could help cut your costs. Have an Osborn Brushing Specialist analyze your operations and submit a confidential written report to you on how you can benefit with power brushing. An **OBA** costs you nothing. Call or write *The Osborn Manufacturing Company, Dept. C-25, 5401 Hamilton Avenue, Cleveland 14, Ohio.*

Osborn Brushing Analysis

TO HELP YOU DISCOVER HIGHER QUALITY AND LOWER COSTS WITH POWER BRUSHING

Wilson "Rockwell"* Hardness Testers



• Hardness testing standards of the metal industry have been set and maintained by WILSON "Rockwell" Hardness Testers since 1921. In steel mills, non-ferrous mills and metal fabricating plants everywhere, WILSON "Rockwell" standards have been the mark of perfection for a generation.

What is your testing problem? Whether your material is hardened steel, sheet metal, small parts, tools, rounds, tubes, soft metals or plastic materials—all are tested quickly and accurately by one of the many WILSON models.

WILSON "Rockwell" precision has made them the standard by which all other hardness testers are compared. The WILSON full line makes it unnecessary to compromise with less than the tester most suited to *your* requirement.

Let a WILSON expert discuss your hardness testing problem. There is no obligation.

BOOTH 1228
National Metal Exposition
International Amphitheater
Chicago • November 1-5, 1954

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Wilson Mechanical Instrument Division
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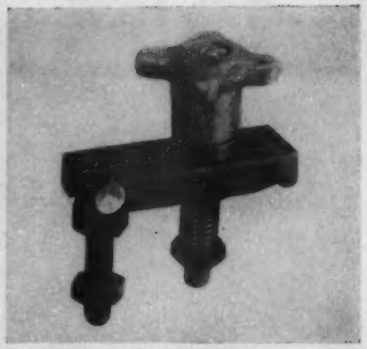
230-B Park Avenue, New York 17, N. Y.

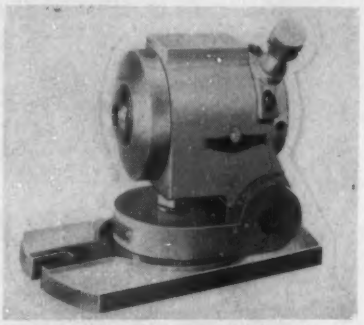


Harco Fixture Clamps

Positive right-angle clamping is obtained by use of three-point rocker action. Contacting point of the clamp bar is radiused to correct any misalignment due to variance in the thickness of the parts being clamped. Use of hardened spherical radius washers and radiused clamp rests corrects this misalignment at the fulcrum and supporting points.

Clamp straps are heat-treated to obtain a hard, wear-resistant surface, and are ductile to withstand extreme loads. Available in several sizes and lengths for either hand or wrench clamping.

Harco Engineering, 12092 Woodbine Ave, Detroit 28



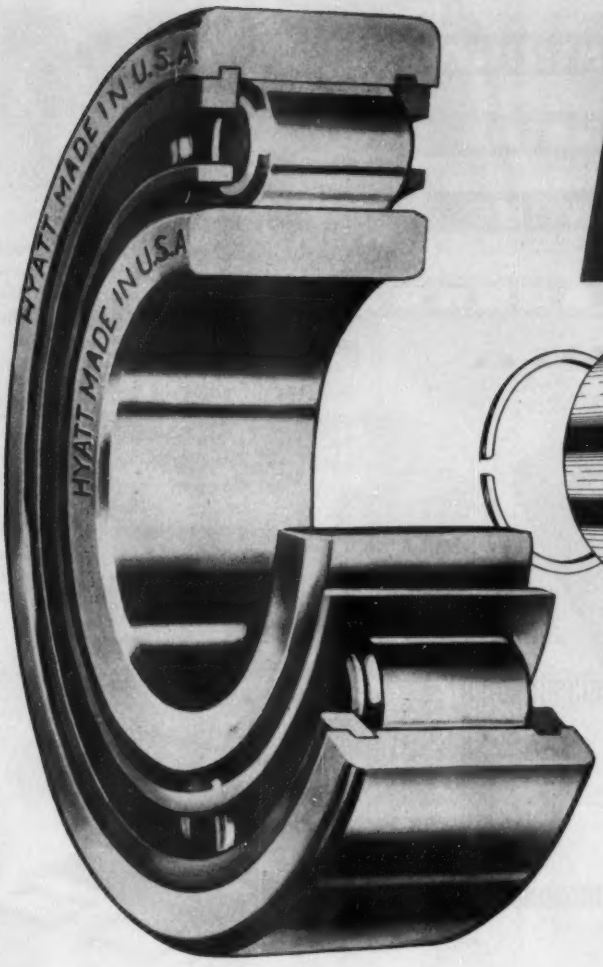
Universal Dividing Collet Head

Model C-404 universal dividing collet head can be used for production work of equal or irregular circular spacings with use of an exact division index plate, and the CA755 Quick-Action collet closure.

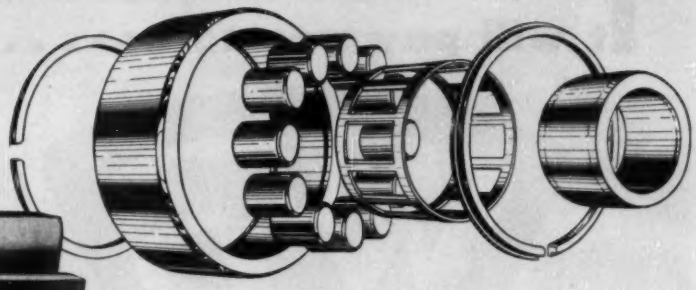
Tool is adaptable for collet grinding on external grinder; for sharpening side and plain milling cutters; as an angle dresser with use of CA775 angle wheel dressing attachment; as radius dresser with CA785 radius dressing attachment; to mount a 3- or 4-jaw chuck by use of CA795 chuck adapter.

Device has 360° full swivel of head on base; 0 to 90° inclination; indexing plates available from 2 to 36 spacings.

Kuma Tool Co, 8751S State St, Chicago 19, Ill



A-TS



one of many Hyatt bearings offering capacity– separability– long life

The Hyatt A-TS Bearing is one of five basic Hy-Load types featuring a separable inner race.

Like all Hy-Loads, the A-TS is built with cylindrical rollers, so that it offers highest capacity for radial loads, plus the long, troublefree service assured by Hyatt's precision manufacture. But beyond that, this particular Hy-Load type offers the design advantages of interchangeable separable components.

With inner races removed, bearings of this type may be applied with rollers operating directly upon the surface of a suitably hardened shaft. This permits the use of larger-diameter shafts or smaller-size bearings, resulting in greater shaft rigidity or a saving in the cost of the bearing.

If you aren't already profiting through the use of Hyatt Hy-Load Bearings, contact a Hyatt sales-engineer or write today for our Catalog No. 150.

HYATT ROLLER BEARINGS

STRAIGHT BARREL TAPER

HYATT BEARINGS DIVISION ▼ GENERAL MOTORS CORPORATION ▼ HARRISON, NEW JERSEY

If production in your plant requires a wide range of these operations

MACHINING
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It will pay you to use . . .

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BASE

When finish or tool life are not up to requirements, you will get the desired results by fortifying your present cutting oil with W & B Base.

You can blend your own specialized oil for machining, grinding and drawing by adding W & B Base to inexpensive petroleum oil.

You save two ways over buying a ready-mixed oil for every requirement:

1. Cost per gallon of oil is greatly reduced.
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It is easy and economical tc get just what you want by enriching metalworking lubricants with W & B Base.

Write for new catalogue of W & B Industrial Lubricants with helpful blending guide for W & B Base.

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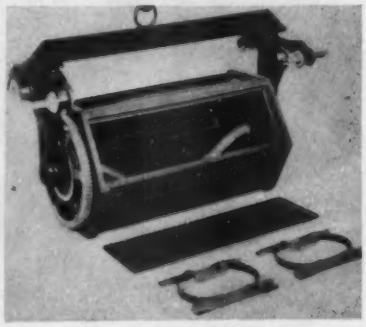
Originators of Grinding Lubricants

Bore-Holding Device

Expanding collet arbor, called Hole-True, is designed for secondary turning and facing operations where concentricity and/or squareness to the bore are desired.

Setup time is minimized; arbor is inserted in place of a standard 5C collet, and proper adapter is slipped on. Device connects to and is activated directly by the drawbar. Shoulder distances are held precisely, even though bore sizes vary. Available in sets consisting of master collet arbor and three adapters to hold in ⅜, ½, ¾, and 1-in. bores.

The Medelton Co, 335 E 142nd St, Bronx 54, NY



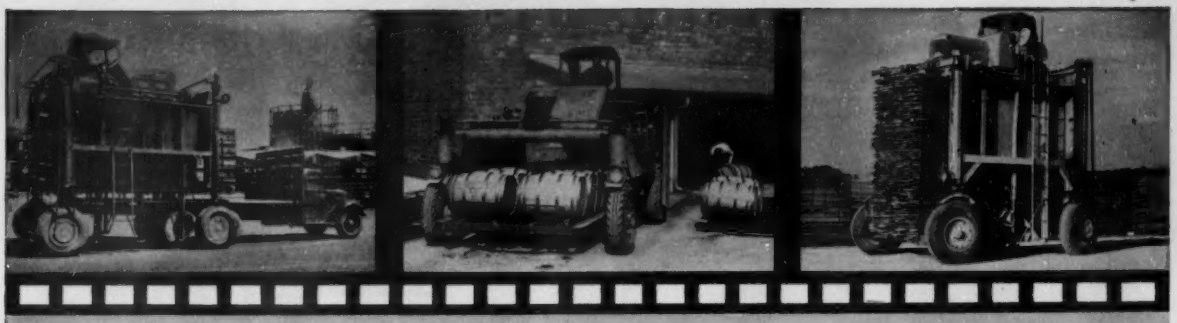
Tempron-Lined Barrel Withstands Higher Temperatures, Loads

Tempron hard rubber lines plating barrel, providing advantages of higher loads, higher temperature resistance, and better abrasive resistance. Interlocking barrel panels and ribs provide strength and permit individual replacement of parts. Additional equipment available is a Teflon liner or membrane with very small perforations which can be installed in the cylinder with only minor modifications.

Udylite Corporation, 1651 East Grand Blvd, Detroit 11

TTCO die check, used with a standard dial indicator, will quickly check side walls of a die for squareness and imperfections. Can also be used to check squareness for the general run of tool and die-making operations. Base has permanent magnetic inserts to aid in keeping tool in position when in use.

Tietzmann Tool Corp, Englewood, Ohio



One man loads it . . . in 3 seconds, up to 50,000 lbs. . . .

One man drives it . . . speeds up to 56 mph

One man unloads it . . . in 3 seconds

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You can revolutionize your handling operations! You can move materials faster, farther, at less cost, and this new movie shows you how to do it. As in the above pictures from the film, you'll see the Ross Carrier handling pineapples, whiskey barrels, lumber packages, heat exchangers, cotton bales, steel tube—for aggressive, cost-conscious companies which have discovered the unique advantages of over-the-load handling. If you are sincerely interested in knowing what's new in materials handling, you won't miss this free movie. It's available on a loan basis—simply send the coupon to reserve your showing. We'll mail the film to you—your only cost is return postage.

CLARK EQUIPMENT

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CLARK EQUIPMENT COMPANY
Benton Harbor 3, Mich.

Send "Over-the-Load" movie for showing on (give 2 choices):

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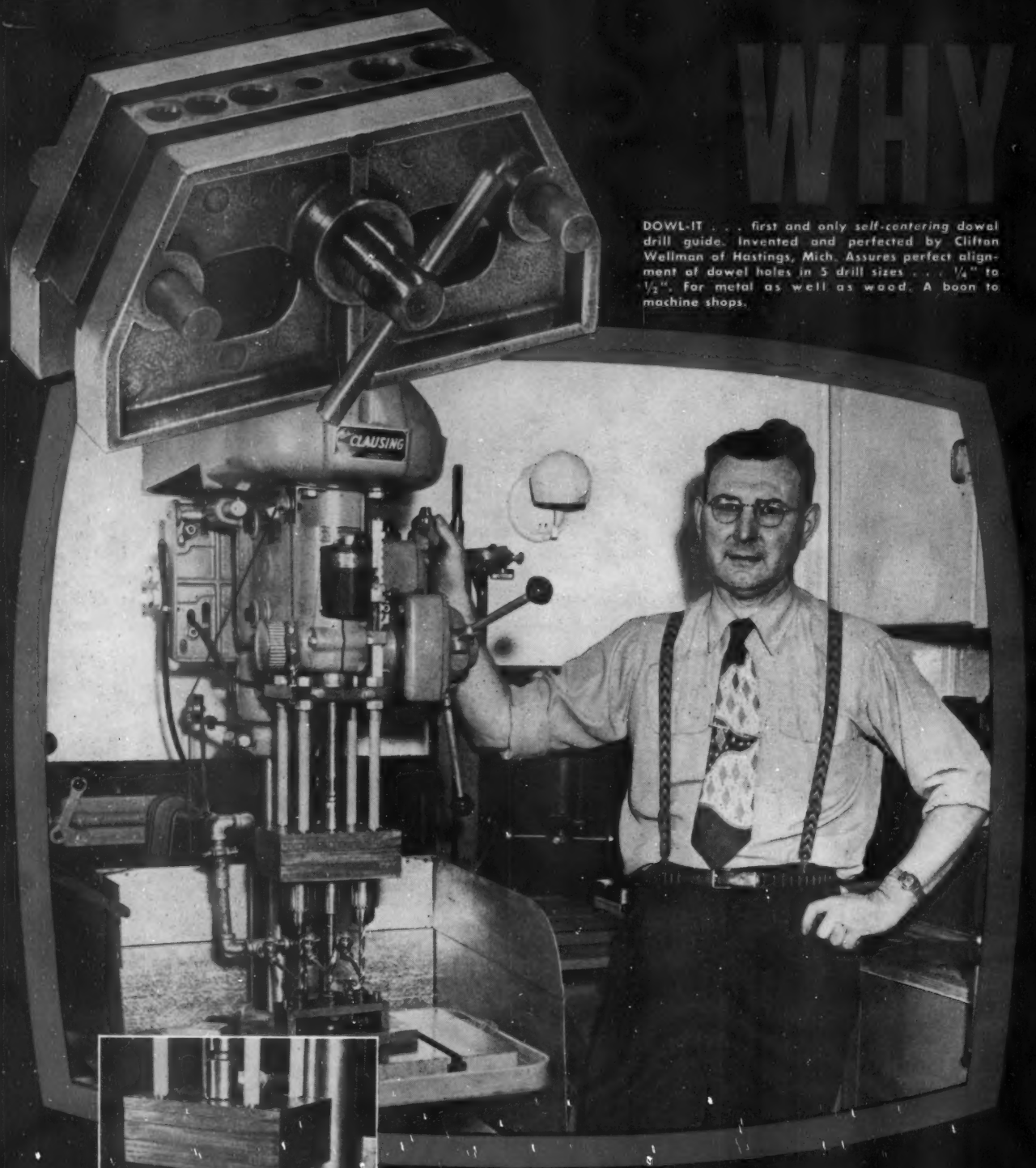
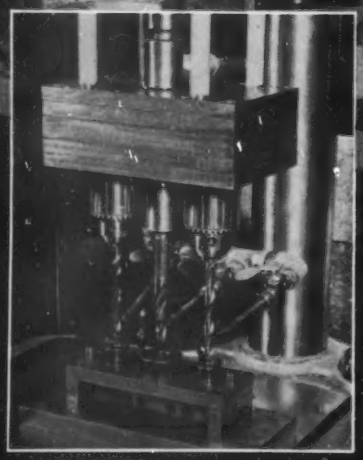
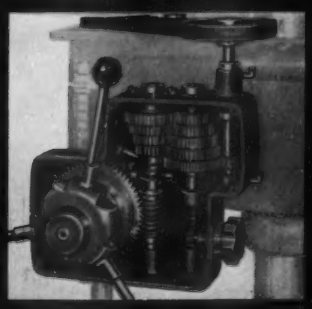
WHY

DOWL-IT . . . first and only *self-centering* dowel drill guide. Invented and perfected by Clifton Wellman of Hastings, Mich. Assures perfect alignment of dowel holes in 5 drill sizes . . . ¼" to ½". For metal as well as wood. A boon to machine shops.





Wellman's big job was accurately locating and drilling guide holes and vise screw hole. To do this he designed and built his own multiple drill head, locating and drilling three holes in one operation and two in another. Three hole operation is illustrated.



CLAUSING POWER FEED DRILL PRESS exactly suited Wellman's requirements. He liked its bigger tool and job capacity; the efficiency of **CLAUSING'S** power feed with positive gear drive instead of belts; oil bath lubrication and dial feed selection; overall heavy duty construction and accurate performance.

Wellman CHOSE THE 18" CLAUSING POWER FEED DRILL PRESS TO *SPEED*

PRODUCTION OF SELF-CENTERING DOWEL DRILL GUIDES

Drilling three holes (½", ⅜" and ¼") 1½" deep, thru ⅝" thick cold rolled steel . . . *simultaneously and in perfect alignment* . . . is a tough assignment for any drill press. By using a specially designed head with three permanently spaced chucks, Wellman does different operations on the same job with his CLAUSING, by changing the drill sizes and using two or three of the chucks. The combination of the CLAUSING and this head, speed his production about one-third. "My new CLAUSING really does a slick job," says Wellman, "and with POWER FEED the tough steel yields like butter."

Study these CLAUSING PLUS VALUES

Capacity 1" in cast iron, ¾" in steel. 6½" spindle travel for efficient use of production chucks. 63/64" diameter spindle with choice of No. 3 M.T. nose, ¾" or 17/32" Jacobs chuck. 39" maximum distance spindle to table. 50" maximum distance spindle to base. Motor: ¾ to 1½ H.P. ⅝" B-section belt for efficient transmission of power. Speed range with 1725 RPM motor — 390, 650, 1100, 1850, 3000. With 1140 RPM motor — 250, 480, 800, 1200, 1950. Four ball bearing drive, with 3 sealed-for-life and 1 double-row, double-shielded ball bearings. Both races in double row bearing absorb drill thrust. Exclusive Vernier depth stop with control accurate to .001". Position mechanism, furnished, moves BOTH head and table. Double coordinate locks on head and table.

With POWER FEED — The Greatest CLAUSING Ever!

The new Plus Value CLAUSING 18" Drill Press sets new standards in tool and job capacity, and performance. And with POWER FEED it becomes an outstanding value for production, tool room or general drill operations. Its heavy-duty GEAR DRIVEN power feed is positive and sure with no belt slippage to dissipate power. Drive is through four sets of change gears, worm, worm gear. Instant feed selection by dial — no belts to position. Steel change gears with ½" face. Hardened stress-proof steel worm. Bronze worm gear with ¾" face. Gears run in bath of oil. Heavy-duty Oilite bearings, with ball thrust bearing on worm shaft.

Make any comparison you wish. But by all means COMPARE. Then your first choice is bound to be CLAUSING. Your local ATLAS-CLAUSING Dealer will gladly help you solve any problems you may have.

Atlas CLAUSING — PRECISION MACHINE TOOLS — DIVISION ATLAS PRESS COMPANY — KALAMAZOO MICHIGAN U.S.A.

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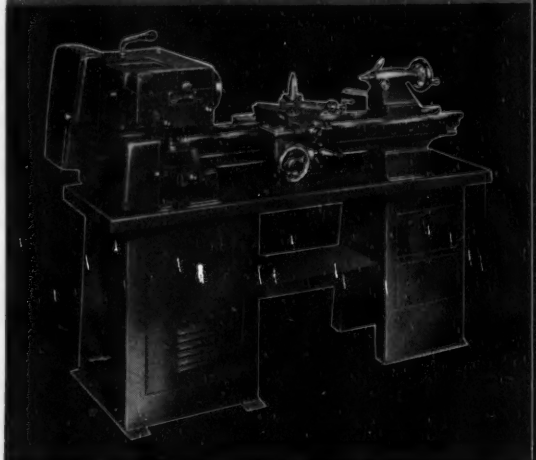
PLUS VALUE LINE

VERTICAL MILLER

Mills, Drills, Bores, Rooms and Shapes . . . at all angles . . . with one work setup! Rigid, high precision spindle head with 7 ball bearings, chrome nickel steel spindle, hard-chrome plated, ground steel quill. 6" x 24" table, 5 spindle speeds, 180 to 3250 RPM. No. 7 B&S or No. 2 M.T. spindle optional.

NEW 12" LATHE

Featuring: "Koro-Precision" Timken tapered roller bearings • exclusive clutch and brake equipped countershaft • 1" collet capacity • 12" swing • 1⅛" hole thru precision ground, forged steel spindle • No. 3 M.T. tailstock with long socket • double-walled automatic apron • quick change mechanism • massive precision ground bed.



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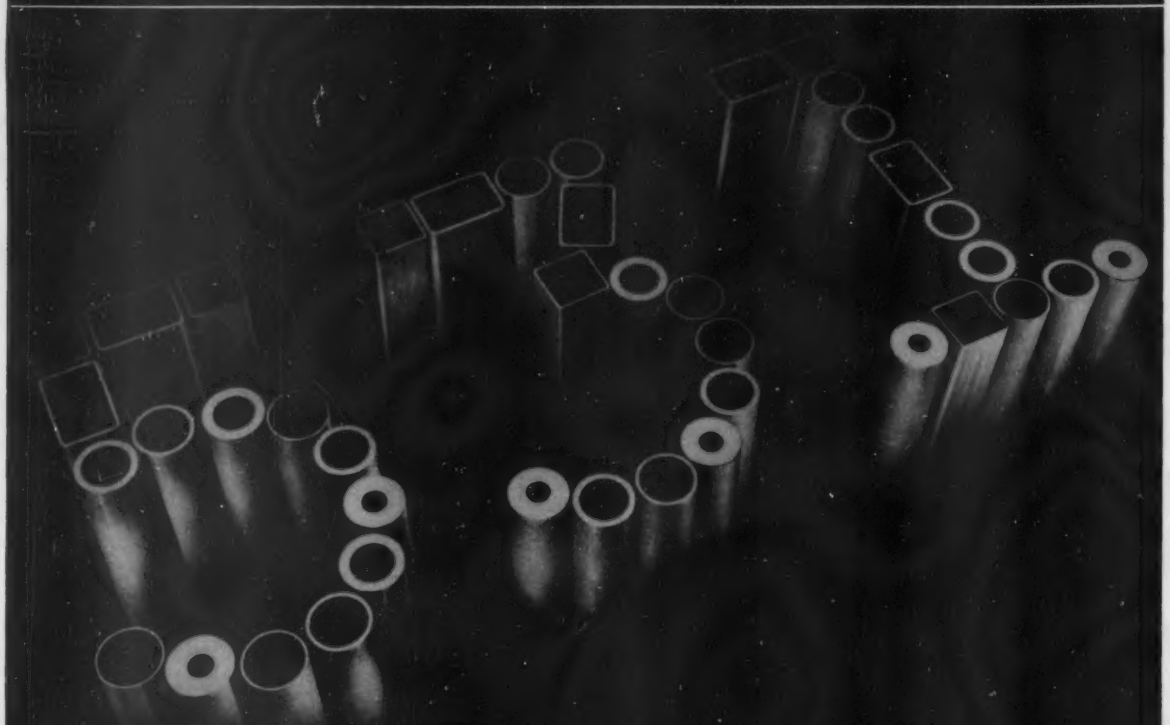
CLAUSING HEAVY-DUTY MACHINE TOOLS • ATLAS METALWORKING MACHINE TOOLS • ATLAS WOODWORKING POWER TOOLS

WHY IT PAYS TO BUY MECHANICAL TUBING FROM US



You have 531 sizes to choose from!

WE carry no less than 531 sizes of Shelby Seamless Mechanical Tubing and can fill orders promptly . . . by the inch or by the carload. No matter what your tubing needs, we can supply you with the best for the job — tubing manufactured by the world's leading producer, National Tube Division of United States Steel.

Our experience in the field of tubing applications has often saved large sums of customers' money—for it is sometimes possible to substitute a more economical type of tubing than you had planned to use.

We carry everything you need. Call us for: mechanical tubing, round and square, seamless and welded; boiler tubing, pressure tubing and pipe; stainless steel tubing, seamless and welded, and stainless pipe.

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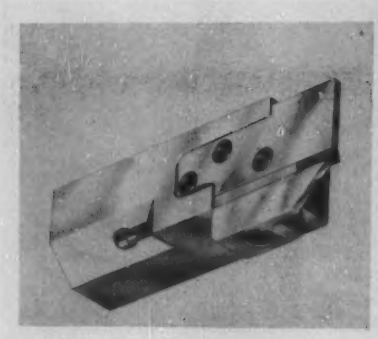


Solid Carbide Inserts Used in Cut-Off Tool

Patented V-blade support locates and holds carbide insert that may be changed in 15 sec. Insert is clamped under heavy offset chip breaker and on top of V-notched backup block of the same width and section as the insert. Front-to-back adjustments are taken care of by a setscrew in the tool body behind the insert.

Tool body need not be changed when dull cutting insert is replaced. Tools for turret lathes, automatics, cut-off machines and engine lathes are available.

Portage Double Quick Tool Co, 1026 Sweitzer Ave, Akron 11, Ohio

Mechanical Carbide Toolholder

Mechanical toolholder, designed for round, square, triangular, and diamond-shaped inserts is available in a wide range of sizes.

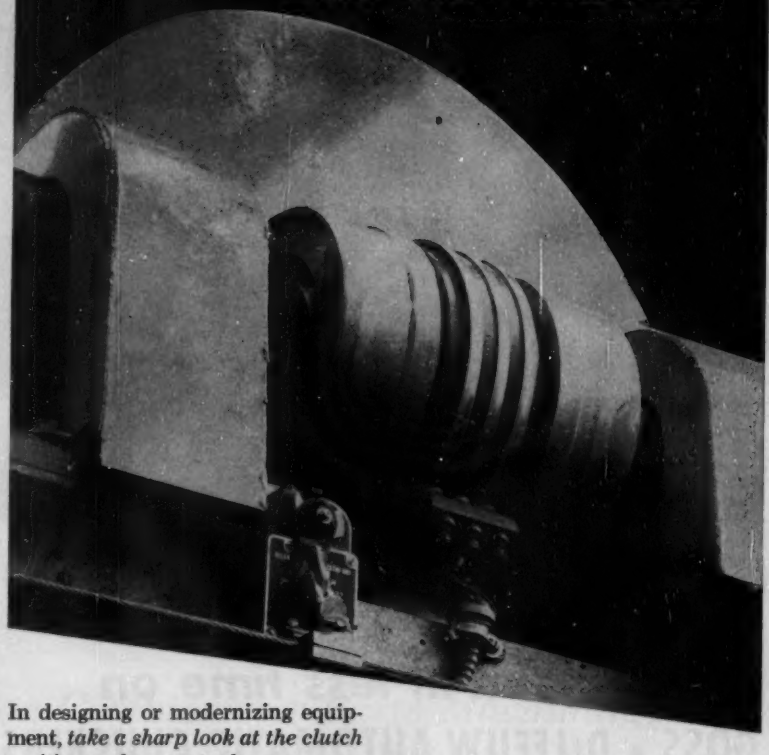
Carbide insert is cammed firmly against shank by heavy steel band and can be released quickly by loosening pointed setscrew on top of shank. Inserts are ground on top and moved up in holder by adjusting setscrew at bottom of shank. This adjusting setscrew is locked into position by a second screw to provide a firm support for the insert.

Wendt-Sonis Co, Hannibal, Mo

ECONOMETER is a control instrument which indicates at a glance whether the right amount (or too much or too little) of metal washing compound is being used in a washing operation.

The DuBois Co, 1120-40 W Front St, Cincinnati 3, Ohio

Stearns can help you cut costs— IN THE CLUTCH



In designing or modernizing equipment, *take a sharp look at the clutch* — it's one key spot where you can hit high operating costs.

And you can hit these costs hard with a matched-to-the-machine Stearns magnetic clutch or clutch-brake combination. Here's why:

In addition to Stearns wide range of standard models, Stearns will custom-build clutches to fit your machine exactly — no makeshifts, no "almost rights." Stearns clutches provide split-second engagement or disengagement—help machines hold close tolerances.

Make these Stearns advantages work for you:

WIDE TORQUE RANGE — .4 to 30,000 lb foot. Handles everything from business machines to steel mill screwdowns and ball and rod mill drives.

LOW INERTIA — Fast, smooth engagement and disengagement.

VARIED DESIGNS — Through shaft, split shaft, duplex for two-speed drives, forward and reverse drives — other special applications.

WIDELY ADAPTABLE — DC or AC with rectifier. Automatic and remote control. Operates in conjunction with electronic circuits.

QUIET AND COOL RUNNING — Generous friction surface area and low unit pressure.

EASY WEAR ADJUSTMENT — Provides longer clutch life.

SIMPLE INSTALLATION — No toggles, yokes, shifters.

For full details consult your 1954 Sweet's Product Design file or write for Bulletin 226-C-4. 1095

MAGNETIC EQUIPMENT FOR ALL INDUSTRY

STEARNS MAGNETS

STEARNS MAGNETIC, INC., 700 S. 28th St., Milwaukee 46, Wis.

More Pieces COMPLETELY *finished in less time on* GOSS & DeLEEUW AUTOMATIC CHUCKERS

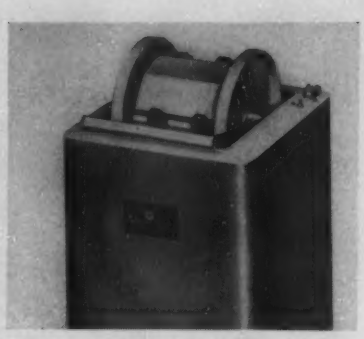
This machine . . . already acknowledged and accepted as a metal-working achievement, and the only standard one of its kind . . . winds up a day's operation with all parts assigned to it completely finished and with no secondary operations necessary. When fully loaded, a complete piece is finished at each index cycle. High productivity is attained with simple tooling.

The "1-2-3" exclusive Goss & DeLeeuw feature provides for finish machining three ends of a part simultaneously or in sequence. All operations are performed in a single set-up, and complete finishing done in much shorter time than by conventional methods.

Send for illustrated literature which fully describes this recent Goss & DeLeeuw development in chuckers. Submit samples of your work for time and cost estimates.

GOSS & DeLEEUW
PRODUCT · QUANTITY · QUALITY

GOSS and DE LEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A.



Barrel Finishing Equipment Available in Small Size

Small-size barrel finishing unit, called Mity-Mite Jr Deluxe, is designed for precision deburring and finishing of small, intricate parts, short runs, or sample lots.

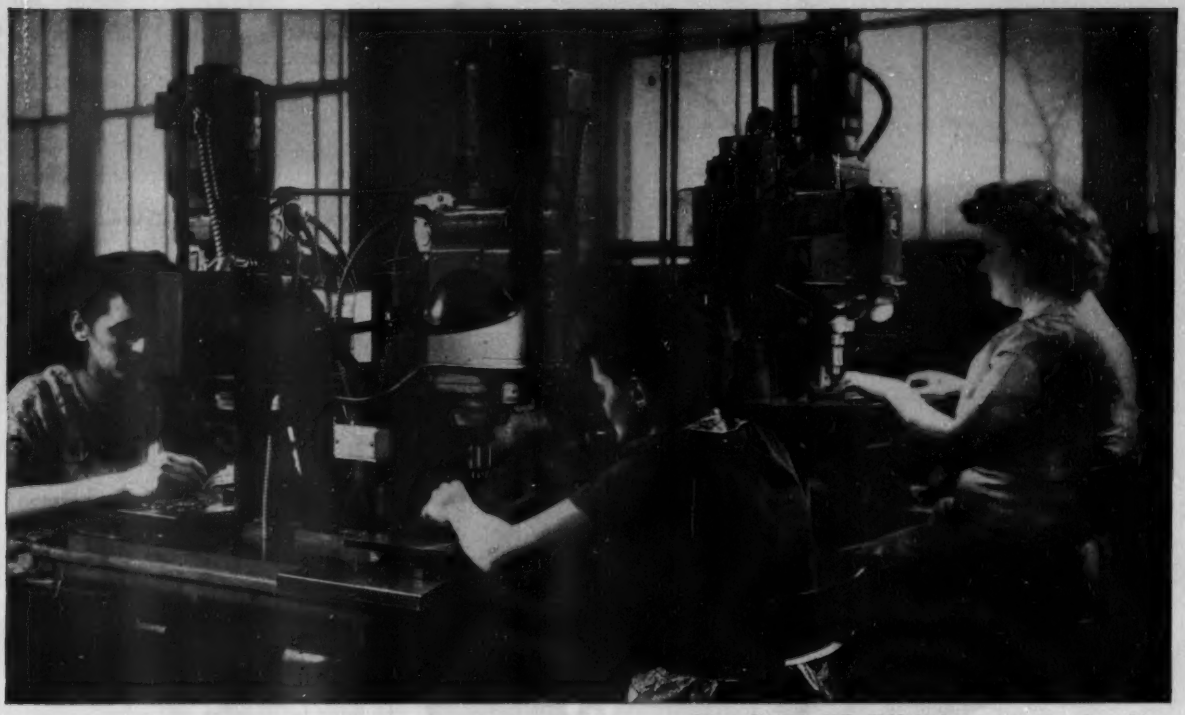
Cabinet style unit comes complete with 1/3-hp motor, 110 v, single phase, and 8 ft of cord. Octagonal barrel is 8 x 8 in., neoprene-lined, with quick-acting clamps on access door. Floor space required is 18x20 in.; over-all height is 36 in. Cabinet housing is painted green; barrel, yellow. Total weight is 115 lb.

Speed-D-Burr Div, Miller Machine Tool & Gage Shop, 3613 San Fernando Rd, Glendale 4, Calif

Rotary Table for Grinders Converts into Lapping Machine

Rotary table for surface grinders uses regular airline sources for power and attains variable speeds of 40 to 100 rpm. This portable attachment is designed for grinding of flanged studs or bushings, bearing spacers, forming rolls, (angle or radius), convex or concave surfaces, flush pin gages, punches or dies (radius or angles).

Only the machine crossfeed is used, reducing machine error and producing precision grinding or fine microfinishes on tool or production items. Table can be used on a sine plate or angle fixture utilizing a standard surface grinder wheel,



Three Rockwell Drill Units have cut costs of machining *Comptometer* parts no larger than ¾" diameter at Felt and Tarrant Manufacturing Company.

Rockwell* Drill Units Cut Costs 11% *on Comptometer Parts Machining!*

Mr. John Schmidt, Chief Tool Engineer at Felt and Tarrant Manufacturing Company states:

- "Our three Rockwell Drill Units handle 15 different automatic operations."
- "The Rockwell Drill Units have not only cut production costs by 11%, but they give us consistent accuracy to tolerances within .0005". Being automatic, there's no chance for operator error in close tolerance work."

"We installed the Drill Units on low cost, shop-fabricated mountings and fixtures, one an old drill press column."

You can match—or exceed Felt and Tarrant's cost savings through better methods in your drilling, tapping, counterboring and kindred operations with Rockwell Air-Hydraulic Drill Units. Let your Authorized Sales Engineer discuss possibilities with you. He not only offers engineering counsel, but can also demonstrate right in your plant. Send the coupon today for his name.

ROCKWELL
15 drive arrangements
—from ½ to 5 hp.
Air-Hydraulic DRILL UNITS
Another Product by Rockwell
*Originally produced by Rockwell under the trade name "Delta."

Drill Unit Division, Rockwell Manufacturing Company
304K North Lexington Avenue, Pittsburgh 8, Pa.

☐ Please send name of nearest Authorized Sales Engineer.
☐ Please send me latest Drill Unit Catalog.

Name_____ Title_____

Company_____

Address_____

City_____ County_____ State_____

The difference between a full game bag at sundown or an empty one is generally a keen nosed pointer that can "nail down" those wily cock birds. The success of many manufacturer's products has often depended upon the gear grinding specialists at Vinco. Ground gears up to 24" diameter and from 180 to 1 pitch, can be supplied. Gears from 80 pitch up to 12 pitch and in diameters up to 8½" are ground with amazing speed and accuracy on special machines designed, made and used by Vinco. Whether you need gears having very close tolerances or gears with liberal tolerances, call Vinco . . . You will learn why a Vinco specialist is your best bet.

VINCO CORPORATION, 9125 Schaefer Hwy., Detroit 28, Mich.

VINCO®

MILLIONTHS OF AN INCH FOR SALE

Metal Component Parts Mass Produced • Aircraft and Commercial Gears • Model B-1 Dresser • Precisiondex • Spline Gages Master Gears • Gear Rolling Inspection Fixtures • Camshaft Comparators • Optical Master Inspection Dividing Heads • Involute Checker.

TRADEMARK OF DEPENDABILITY

eliminating dressing of large expensive external wheels for side grinding. Can be used with standard permanent magnetic chucks, or simple fixtures to suit the part. Lapping plates mounted on top of the table converts it into a portable lapping machine.

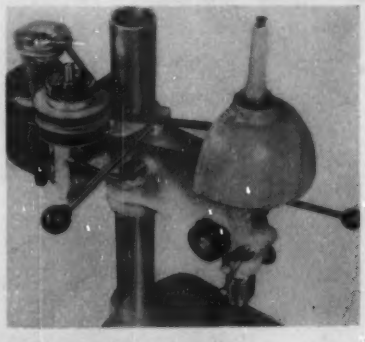
Vulcan Tool Co, 730 Lorain Ave, Dayton, Ohio

Bandsaw Welder Includes Built-In Grinder

Bren/Weld portable bandsaw-blade welder has larger transformer for more uniform welding, takes blades from 1/16 to ¾ in. wide; 50% larger motor powers the grinding wheel built into the cabinet.

Unit weighs 35 lb, and handles complete saw-joining job, eliminating saws and filing. Welding jaws are solid copper. Cabinet is 7¾x12x7 in. and operates on 110 volt ac.

Kasson Die & Motor Corp, 32-14 Northern Blvd, Long Island City 1, NY



Drillpress Drive Provides A 9 to 1 Speed Variation

Variable speed drive for any drillpress having a 2¾-in. column provides an over-all speed variation of 9 to 1, thus making possible a greater range than is standard with most presses.

Mounting bracket is slipped over the column, and V-belts of the correct length are applied. Bracket sup-

FILTRATION for AUTOMATION

Delpark

MAKES AN ASSIST ON Quality Control AT IBM

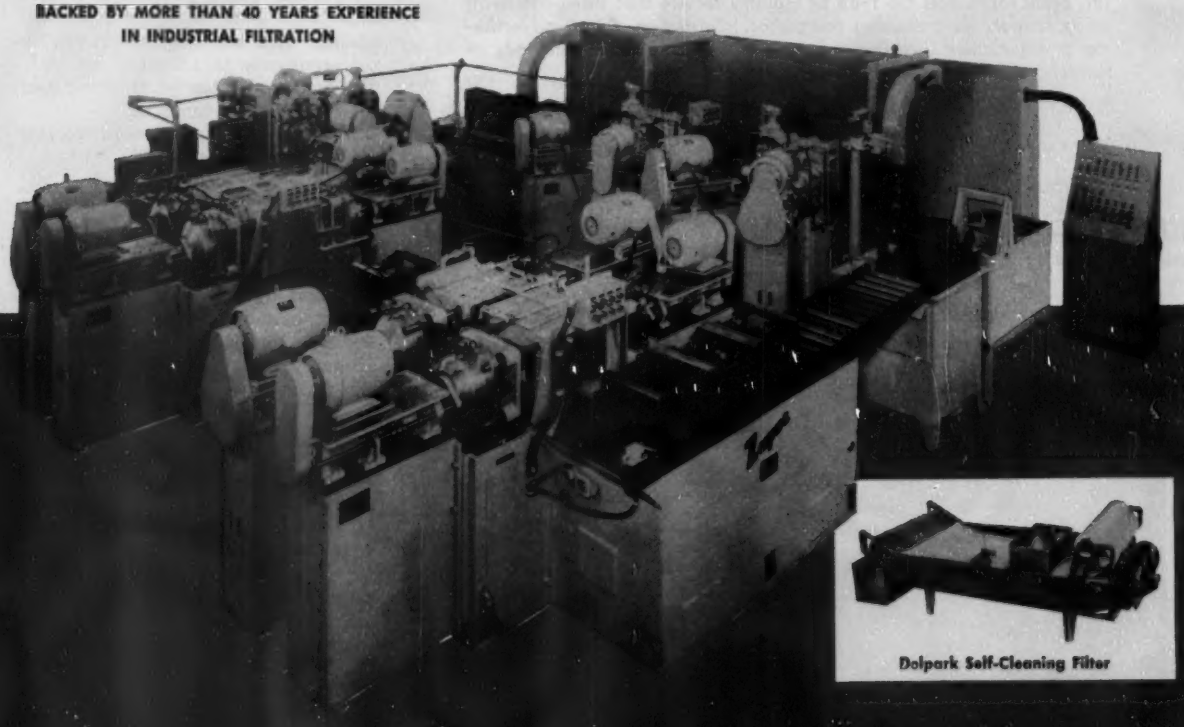
These Zagar pallet-type transfer machines at IBM perform numerous drilling operations on aluminum frames for the famous IBM typewriters.

Here is a fine example of Automation . . . and backing up this unit is automation in filtration. You won't see it in the picture, but . . . Delpark filtration cleans coolant from the 206 drill spindles. Greater accuracy of drill hole size, longer drill life, more efficient tool operation are but a few of the major savings gained through Delpark filtration. Delpark is one reason why up to 144 parts per hour are handled on this unit with but two operators. Credit IBM and Zagar tool engineering for foresight . . . credit IBM tool service for production know-how . . . credit Delpark for filtration as modern as today's automation.

For your filtration problems . . . for automation or normal procedure . . . contact Delpark for competent field engineering. There's no obligation. *Write today.*

DELPARK INDUSTRIAL FILTRATION

BACKED BY MORE THAN 40 YEARS EXPERIENCE IN INDUSTRIAL FILTRATION



Delpark Self-Cleaning Filter

INDUSTRIAL FILTRATION COMPANY, 113 INDUSTRIAL AVENUE, LEBANON, INDIANA

This Holcroft Book belongs in YOUR Technical Library

"We are going to invest in our own heat treat furnace. Where should we start—what furnace facts should we know?"

"Do we know the difference between 'direct' and 'indirect' firing?"

"Do we know all the methods of handling stock, and which would best suit our needs?"

Questions like these are best answered by a manufacturer who specializes in building furnaces for specific jobs. You'll find the answers —compiled from a world of experience—in Holcroft's book "Blazing the Heat Treat Trail."

For example, there's a frank discussion of all of the basic factors that govern the selection of a furnace: the fuel to use, a discussion of open firing versus controlled atmospheres, an illustrated section on stock handling, and suggestions as to how your heat treat process can be tied right into the production line.

This book represents the type of industry service that stamps Holcroft as its leader. As continuing sources of information, future advertisements will further describe different furnace types and methods of handling stock.

You'll find it's a good bet to come to Holcroft first!

Want a copy of this book for your files? Just write—right now!

Holcroft & Company, 6545 Epworth Blvd., Detroit 10, Michigan.

PRODUCTION HEAT TREAT FURNACES FOR EVERY PURPOSE

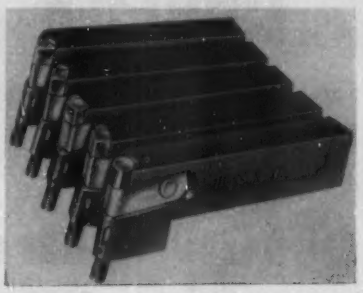
6545 Epworth Blvd. Detroit 10, Michigan

CHICAGO, ILL. CLEVELAND, OHIO HOUSTON, TEXAS PHILADELPHIA, PA.

CANADA: Walker Metal Products, Ltd., Windsor, Ontario EUROPE: S.O.F.I.M. Paris 8, France

ports the spring-actuated sheave which assures maximum pull at all speeds. Control knob gives quick change to any speed desired, and locks in position. Original standard drillpress motor, cone pulley, and spindle cone pulley are utilized; belts are standard V-belts. Spring holds proper tension on both belts at all times. Price, $22 FOB.

Speed Selector Inc, 118-W Noble Court, Cleveland 13



Toolholder Has Height Gage For Rapid Insert Setup

Multicut toolholder now incorporates a precision-ground carbide height gage, permanently brazed to the holder adjacent to the insert slot. This factor is said to eliminate need for additional rules or gages ordinarily required in re-setting inserts exactly on center.

Operator raises insert until it is flush with gage; by feeling the top of both with finger tip, insert can be set accurately to 1/1000 of an inch. Toolholder also has an elliptical slot for easier insert removal.

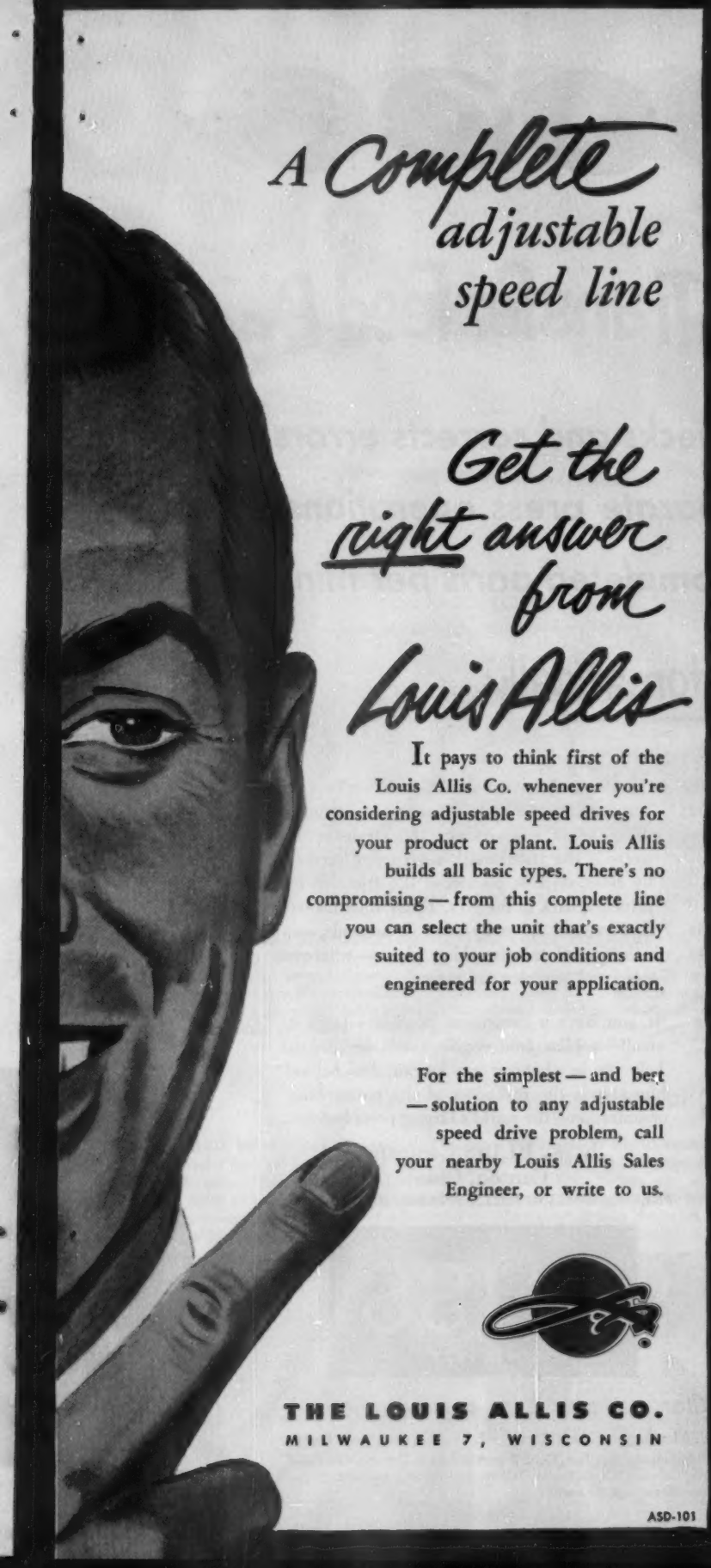
Wesson Co, 1220 Woodward Heights Blvd, Detroit (Ferndale 20) Mich

Line of impact sockets for production line and maintenance work includes ½-in. and ⅝-in. drive wrenches, with hex openings in regular and long lengths, plus double square openings in regular lengths. Socket opening are hot broached for accuracy; cadmium plate finish is rust-proof and cannot chip, crack, or peel.

Blackhawk Mfg Co, Milwaukee 46, Wis

Remington-Rand card-to-tape and tape-to-card converters are machines which provide for automatic transfer of data from punched cards into perforated tape and from tape into cards. System is particularly suited to an operation that requires a constant exchange of accounting information between distant points. Details included in folder TM-841.

Remington-Rand, Inc, 315 Fourth Ave. New York 10. NY



A Complete adjustable speed line

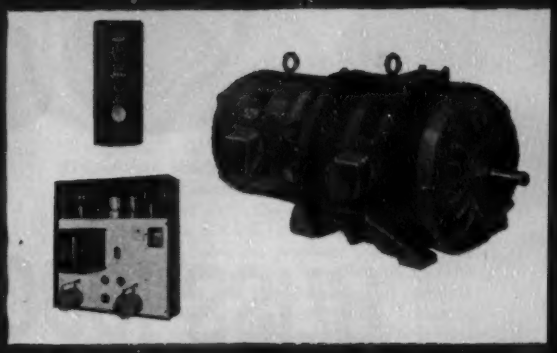
Get the right answer from Louis Allis

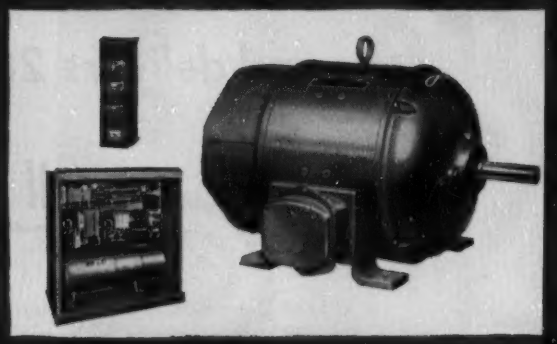
It pays to think first of the Louis Allis Co. whenever you're considering adjustable speed drives for your product or plant. Louis Allis builds all basic types. There's no compromising — from this complete line you can select the unit that's exactly suited to your job conditions and engineered for your application.

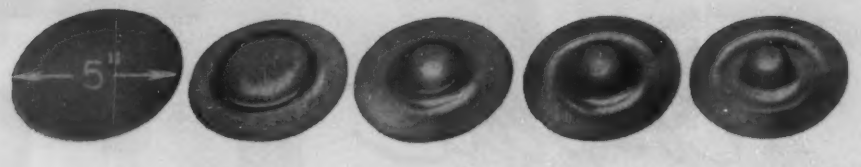
For the simplest — and best — solution to any adjustable speed drive problem, call your nearby Louis Allis Sales Engineer, or write to us.

THE LOUIS ALLIS CO.
MILWAUKEE 7, WISCONSIN

ASD-101







BLISS' 1000th Transfer Feed Press

*It feeds itself \ checks and corrects errors \ performs 11 separate press operations \ and delivers 28 completed parts per minute *

all automatically

At Ford Motor Company's Ypsilanti plant, the Bliss 13-station transfer feed press turns out starter brush end plates—a part which was formerly die cast.

The press takes the 0.090-inch blank, puts it through six successive draws, flanges it, irons the cup within a tolerance of ±0.0005" on the I.D., restrikes the flange, pierces ten tiny holes, lances four locating tabs, and then trims the part to final diameter. Tolerance range throughout: from ±0.0005" to ±0.005".

And while all this is going on all the attendant has to do is keep the turret mechanism loaded with blanks!

However, the truly unusual feature of the press is this: practically everything that can go wrong has been anticipated and guarded against by electrical control circuits. Tiny switches police trouble areas and take corrective measures when needed.

In short, the press thinks as it works—*that's* automation. An up-to-the-moment example of Bliss press engineering, this transfer feed press is the thousandth such press produced by Bliss since it pioneered the transfer feed principle back in the 90's. Today Bliss transfer feed presses are a by-word in arsenals, can-making and metalworking plants—wherever speed and accuracy are musts.

If you have a pressroom problem—large or small—a Bliss field engineer will be glad to help you in whatever way he can. And behind him stands the resources of the entire Bliss organization—the world's largest press builder.

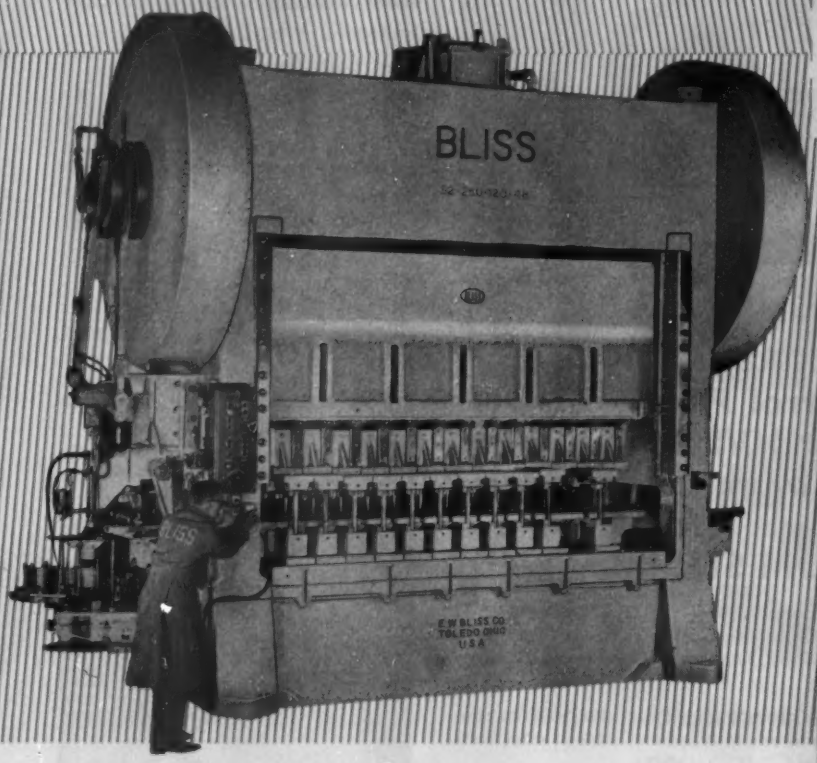
E. W. BLISS Company
Canton, Ohio
PRESSES, ROLLING MILLS, SPECIAL MACHINERY

BLISS
SINCE 1857

Remember: BLISS is more than a name . . . it's a guarantee

Subsidiary: The Die Supply Co., Cleveland, O. • E. W. Bliss (England) Ltd., Derby • E. W. Bliss Co. (Paris) France
U. S. Plants in Canton, Salem and Toledo, Ohio; Hastings, Michigan; and San Jose, Calif. *Branch Offices* in Chicago, Cleveland, Dayton, Detroit, Indianapolis, New Haven, New York, Philadelphia, Rochester, Toledo; and Toronto, Canada.
Other representatives throughout the world.

STAMPING SEQUENCE... The first six, from left to right, are successive draws. Step seven forms the flange. Eight irons the cup to size (tolerance here: 0.0005" on the I.D.) and restrikes the flange. Step nine: ten holes are precisely pierced. Next, the four locating tabs on the flange are lanced. The final operation trims the diameter all around. Blank size: 5" diameter by 0.090" thick. Tolerance range: from ±0.0005" to ±0.005". Production rate: up to 28 per minute.

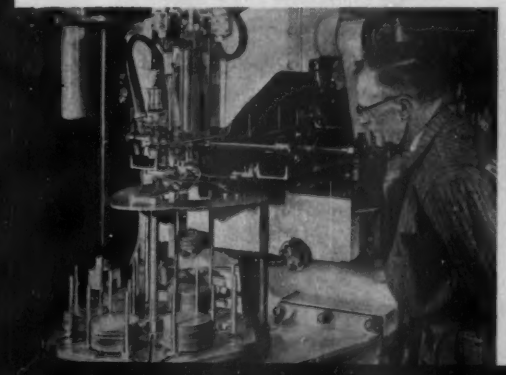


VITAL STATISTICS... Straight side double crank design; 120" between uprights; 48" front to back; single geared with twin drive; gears totally enclosed and immersed in oil bath; speed adjustment—14 to 28 spm; stroke of slide 8"—motorized slide adjustment range 10"; cam-actuated knockouts in individual slides accommodate various shell heights; high-speed single disc air clutch. Press and die design has purposely been kept flexible so that it can be readily adapted for a variety of jobs.

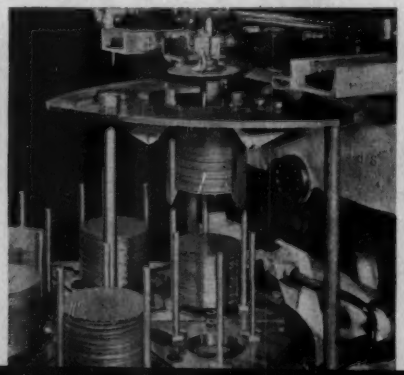
DOUBLE TROUBLE... When two blanks stick together and feed into the press, they lift this feeler, close the micro-switch and actuate a solenoid which opens a trap door in the press bed. The blanks fall through the trap door; the press goes on uninterrupted. That's typical of the many automatic safeguards incorporated into the press.

Automatic feed system: all it requires is loading

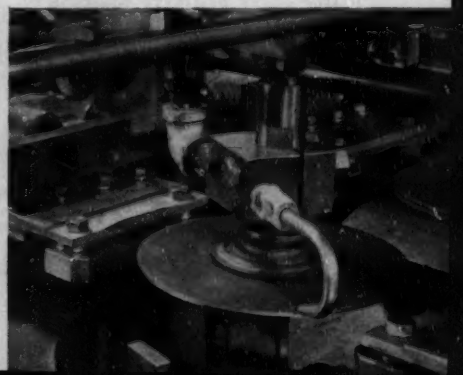
OVERALL VIEW shows the position of the automatic feed mechanism at the entry end of the press. Note that one load of blanks has been picked up from the six-station turret located below. Turret now moves next load of blanks into the ready position.



CLOSER VIEW shows vacuum cup holding a single blank between the slide bars. Close examination reveals the gripping fingers which will close in on the blank, grip it and then move it into the press, release it and return to their original position.



STILL CLOSER VIEW clearly shows gripping fingers in ready position as blank is held by vacuum cup. Curved tube in foreground shoots a blast of compressed air at side of blank to force off extra blanks that may be stuck to top one.



McCaskey Control of Work-in-Process used by Strom Steel Ball Co., Cicero, Illinois, largest independent manufacturer of steel balls.

McCaskey Inventory Control of finished stock.

McCASKEY Systems control PRODUCTION and INVENTORY with minimum clerical work for STROM STEEL BALL CO.

Strom controls work-in-process and finished stock with two McCaskey installations, briefly described by Kenneth E. Swanson, Industrial Engineer.

The first gives the Production Manager ***at a glance*** all the facts he needs to control production and process inventory of hundreds of types and sizes of steel balls by size and departments. Among them are:

(a) units produced by each department against schedule;
(b) location and amount of all process inventory;
(c) sizes or departments behind schedule, requiring corrective action;
(d) bottlenecks, if any, in flow of production;
(e) inventory banks to be increased or decreased.

McCaskey Inventory Control of all material in finished goods stock replaced a machine-posted system several months ago. The Sales Department must have dependable data on units available at all times to make definite commitments for shipments from stock. McCaskey provides this accurate, ***up-to-date*** information.

McCaskey Controls quickly return their first cost in improved operations, time and effort saving. They require a minimum of clerical work.

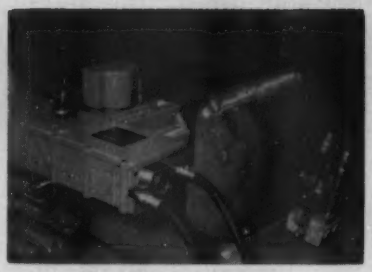
MAIL COUPON FOR COMPLETE INFORMATION

McCASKEY REGISTER DIVISION
Victor Adding Machine Company
ALLIANCE, OHIO

Please send me complete facts on: McCaskey Production Control ☐; Inventory Control ☐.

Name .....
Position .....
Company .....
Address AM-10-54

McCaskey
INDUSTRIAL CONTROLS
PRODUCTION - INVENTORY
TOOLS - MAINTENANCE - COSTS
THE McCASKEY REGISTER DIV.,
Victor Adding Machine Co.
ALLIANCE, OHIO
Galt, Canada Watford, England



Hydraulic Wheel Dresser Uses Cam Mechanism

Model 32 is designed especially for surface grinders and is set up by removing cover plates and changing contour templets. Diamond movement across wheel is hydraulically actuated, and dressing speed is controlled by valves.

Reduction of shape from enlarged templet to the wheel is made by cams in the form of inclined planes without any pantograph linkages. Dresser has offset adjustment of ½ in. Accuracy to tenths is claimed; dresser will follow any form that can be entered by the diamond.

Hoglund Engineering & Mfg Co, 343 Snyder Ave, Berkeley Heights, NJ

Gripper Arms on Yale Truck Eliminate Need for Pallets

Yale's Model RSEAT-2 Warehouser Extend-A-Load truck, equipped with Rheem gripper arms, can reach out and select loads consisting of cartons, crates, boxes, and other materials, eliminating need for pallets.

Contact surfaces of arms are coated with a durable, high-friction plastic which grips load securely. Pressure regulator permits varying clamping pressure to suit load conditions. Safety backrest aligns load above clamping position. Loads can be hoisted up to 124 in. above the floor, and are retracted or extended by pushbutton control.

Yale & Towne Manufacturing Co, 11,000 Roosevelt Blvd, Philadelphia 15

Miniature Lubricating System

Compact, automatic lubricating system, known as the L Special.

Unit comprises all the elements of a complete system—reservoir, filter, pump, and meter-units, yet it measures but 2¼ in. high by 1⅜ in. deep by 1½ in. wide. Reservoir holds 20cc, and pump can be adjusted to discharge a total of 0.6, 0.45, or 0.3 cc each time plunger is pulled. It may be installed to discharge into passages drilled in the machine and leading to lubrication points, or it may discharge into tubing leading to these points.

Bijur Lubricating Co, Rochelle Park, NJ

Rugged 2-Ton Press Replaces Kick Presses

Model No. 00 is a heavy-frame unit built to replace manual punching and assembling jobs. Standard stroke is ¾ in., but 1-in. stroke is optional. Flywheel speed is 270 rpm.

Single-trip safety mechanism may be easily changed for continuous operation. Press has heavy-duty inclinable frame, gib adjustments on both sides, bronze ramway wear strips, bronze-bushed flywheel and main bearings, and connecting rod.

Sales Service Machine Tool Co, 2363 University Ave, St Paul, Minn

SPECIFY ADAMAS PREMIUM GRADE 434

for your toughest steel roughing operations including interrupted cuts

- HIGH SHOCK RESISTANCE
- HIGH WEAR RESISTANCE
- HIGH HEAT RESISTANCE
- HIGH DENSITY

Developed especially for removal of large amounts of metal—with minimum feed .015 and maximum feed dependent only on available horsepower—ADAMAS PREMIUM GRADE 434 is outperforming all other carbide grades in hundreds of plants throughout the country.

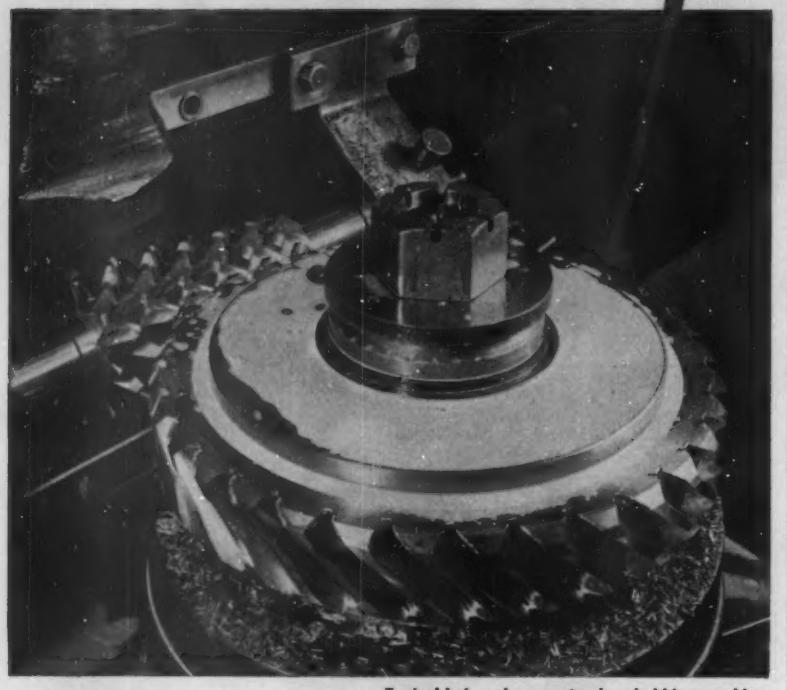
Plant after plant reports large savings in carbide costs resulting from up to 50% increase in tool life. Next time specify ADAMAS PREMIUM GRADE 434 and watch your production go up and your costs go down.

"First with Carbide That Lasts!"

ADAMAS TUNGSTEN CARBIDE®

ADAMAS CARBIDE CORPORATION, KENILWORTH, NEW JERSEY

How CLEVELAND saves you money



Typical hob and gear setup in a hobbing machine at the Cleveland Worm and Gear Company.

on replacement parts

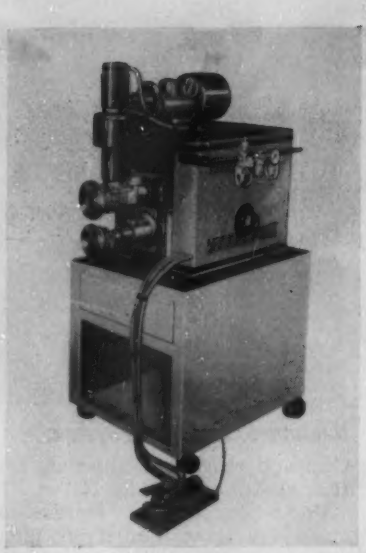
NOT once in a thousand times will this happen—but, with Cleveland you can order a new gear which will run correctly with an old worm that's still good after working perhaps 20 years or more. That's the kind of service you can expect from Cleveland—and here's why!

At the Cleveland factory are stored over 1,300 *different* worm gear hobs and master worms. This enables us to duplicate with precision any gear (or worm) that has *ever* left our plant. This means that if a gear *alone* should ever need replacement, you do not have to buy a complete new drive. Instead, just give us the particulars on your Cleveland speed reducer, no matter how old—10, 20, 30 or even 40 years! In short order, we'll have a new gear ready for you—one that will run perfectly with the older worm.

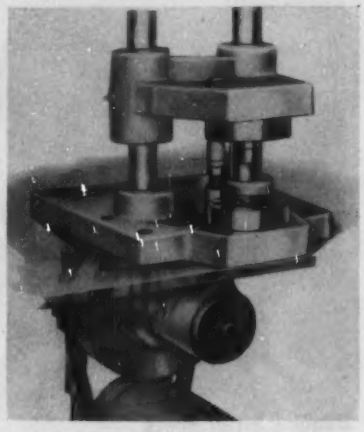
By supplying parts on this basis, Cleveland may be able to save you the cost of a *complete* new drive or the extra expense of special tooling. Isn't this the replacement protection you want when you buy worm gear drives? The Cleveland Worm and Gear Company, 3254 E. 80th Street, Cleveland 4, Ohio.

Affiliate: The Farval Corporation, Centralized Systems of Lubrication. In Canada: Peacock Brothers Limited.

CLEVELAND Speed Reducers



BENCH-TYPE SEAM WELDER has electrode shaft bushings designed to convey 95% continuous current to rollers and work. Another feature enables it to be converted to spot welding. Any pressure desired may be applied on work by regulator controlled double-acting air cylinder. Travel speed is controlled by regulator control permitting speed of 1 to 30 fpm. Transformer 25 to 500kva is specially designed to carry continuous load without heating *—Dyer Weld Co., Kansas City, Missouri*



Power-Di Press Takes Up Less Space

Inverted 1-ton press has die set on top, flywheel and clutch underneath, and motor on the floor. Unit has 1¼-in. standard stroke, 3 in. to 6 in. shut height, and will make 200 strokes per min. Ram and base consist of retainers which automatically align punches and dies of any shapes. Several machines may be aligned for simultaneous piercing, notching, or forming on large sheets.

Swanson Tool and Machine Products, Inc, Erie, Pa

Ingersoll Steel

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Special Steels

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B-W
PRODUCTION

BORG-WARNER CORPORATION

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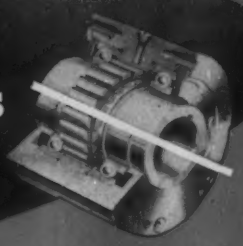
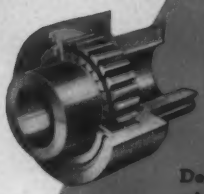
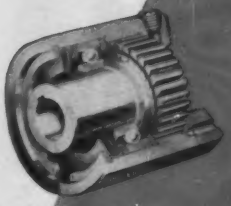


ALL PURPOSE BALL BEARING CLUTCH—Designed for maximum accuracy and long life in *high speed* applications. Ideal for continuous duty, especially when prolonged over-running is a factor; also for rapid indexing operations.



PLAIN BEARING CLUTCH
Designed for slow speed applications where loads are not excessive. In general, tailored for intermittent duty and light loads only.



SPECIAL PURPOSE BALL BEARING CLUTCH—Basically an indexing clutch, it is used extensively on spring coilers for feeding purposes. With adapters, however, it will perform adequately as an over-running or backstop clutch. Additional bearing and oil seal must be inserted before installing.

New **SMALL CLUTCHES**
To meet industry's demand for small size clutches of high torque capacity, low price, long life, and minimum maintenance.

New **LARGE-BORE CLUTCHES**
For backstop applications requiring large-bore sizes.

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CLUTCH-COUPLING UNIT
Required when you are coupling two shafts and want over-running features.

New
SERIES 90 CLUTCHES
Designed for applications where customer desires to provide his own inner race. An economical answer to specific applications. Consult factory for additional information.

This most modern of clutches —the Formsprag Full Complement—has sprags running on concentric races without ramps. Design of the sprag provides a greater load capacity than any other type of working member. And—there are *more* working members (sprags) than in any other clutch-type. Formsprag's full complement of sprags always means MAXIMUM TORQUE CAPACITY in a small, compact unit. *Write today for literature on the unit of specific interest to you.*

Over-running

Indexing • Backstopping

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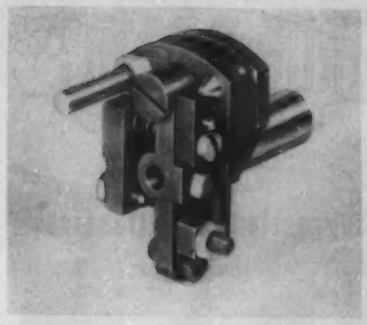
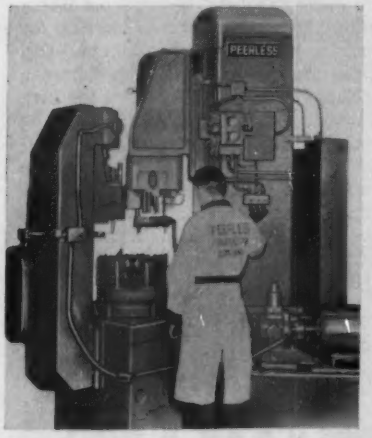


Radial Action Recessing Tool

Amcan Model B recessing tool is cam-actuated by forward motion of the turret, thus eliminating the time usually required for the cross slide to actuate the tool. Setup time is saved since it is not necessary to synchronize lead and cross-slide cams.

Tool will perform either radial recessing, form recessing, or back-end chamfering without a cross slide, or swing recessing from a cross slide without changes or adaptations. Unit moves radially into the work, making it possible to form recesses which cannot be done by conventional recessing tools, and the cam action holds close tolerances throughout long runs without adjustment, even when cutting tools are replaced.

American Cam Co, Bloomfield, Conn



SPECIAL MACHINE drills, chamfers, and taps 160 transfer plates per hour for large manufacturer of automatic transmissions. Vertical machine, two-way, has vertical 14-in. way, hydraulic-feed unit, and welded-steel tapping column with 24-in. 4-station automatic power index. Features include Peerless multiple-spindle head with hardened gears and keyed drives; chrome-plated, leadscrew tapping spindle; hardened, ground and automatically-lubricated ways; and hydraulic and electrical installations to JIC standards

—Peerless Production Co, Detroit, Mich

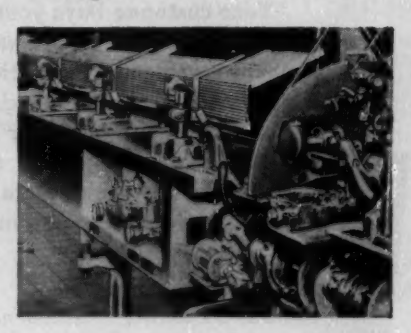
LIPE AML BAR FEED

gears machine production to the steady flow of Time

ALL industrial results are achieved in Time . . . *vital 4th dimension that measures output, costs, profit.* Shorten the time gap between operations . . . shorten the time when machines are "cutting air" . . . keep machines producing at a steady optimum rate during the fatigue slow-down from 10:30 to noon, and from 3 P.M., till closing time . . . *and you are getting 4th Dimension production.* Production that is geared to the steady flow of Time.

Lipe AML Bar Feed Produces from 30% to 100% More Output by Eliminating Time Losses . . .

Time losses account for the enormous differences in output among workmen. By eliminating these losses automatically, the Lipe AML Bar Feed boosts overall production from 30% to 100%. That's because stock is fed to the machine independent of the operator. Constant pressure behind the stock assures uniform speed of feed. No feed fingers to fail or mar stock. No multiple feed-outs, even on the longest pieces.



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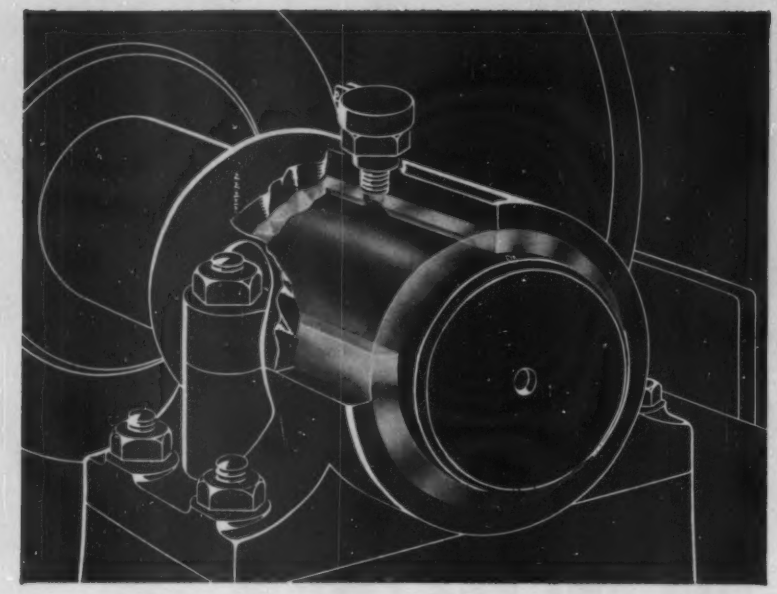

THE WAY TO CUT...

Cost of imitation

If you are using an expensive type of bearing because a competitor of yours uses it you are needlessly saddling expense onto your product if the job could be done as well or better with a less expensive type—as for example the cast bronze sleeve bearing.

Your customer buys your product because it does a job he needs done in the way he wants it done. Your company's name and reputation support your product, and the mere fact that you include unnecessarily expensive bearing types is not a factor in the sale. We suggest you examine your present designs to determine if there are not places where the sturdy, simple, cast bronze sleeve bearing can help you toward necessary cost reductions.

There is a Bunting Engineer near you. Consult him. Or write our Product Engineering Department in Toledo.

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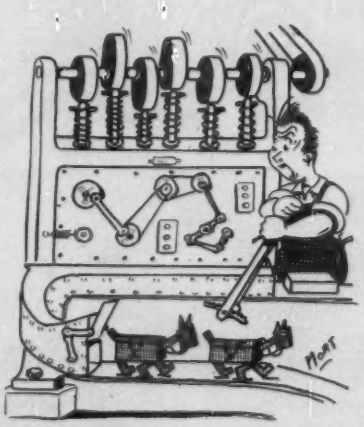
ROUND TABLE *Discussion*

Suggestions or Extractions

Should a toolmaker be eligible to participate in a Suggestion Plan, or is it part of his job to produce new ideas and better processes?

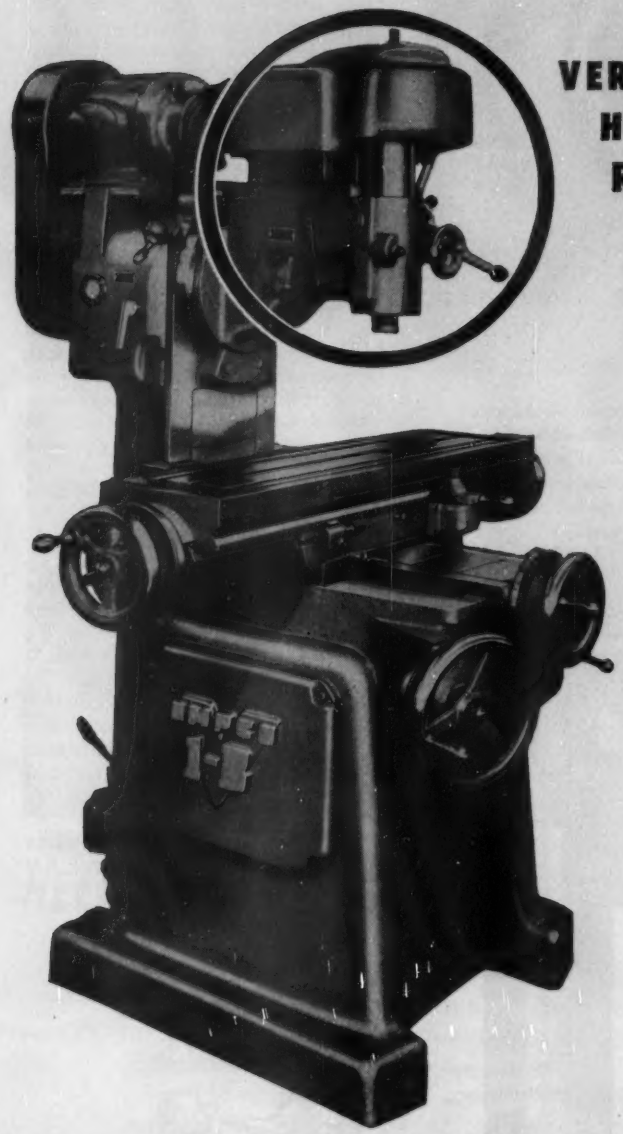
A TOOLMAKER IS HIRED and paid for making jigs, fixtures, etc, in strict accordance with the drawings prepared under the supervision of the tool designer who himself is responsible for the output of correctly formed or machined parts. If the toolmaker has a better idea which will result in a substantial saving in the cost of production of the pieces involved, then he certainly should be permitted to put the suggestion through. If the idea is adopted, then he is entitled to receive payment for his suggestion.

Ed's statement that a toolmaker should not get paid for any valuable ideas he may have would probably result in considerable losses to the firm because toolmakers would make no more suggestions and most likely would start a side issue dickering for private purchase with rival concerns. Of course in a small shop where a toolmaker sometimes makes his own design, he could not expect to be paid extra, but even in these small shops I have known the manager to reward a toolmaker for a particularly good fixture that resulted in a nice profit for the firm. Appreciation of this kind is almost always an ex-



"Hey Boss, they're coming off the production line with a leg missing."

Here's a NEW design feature in Vertical Mills!



VERTICALLY ADJUSTED HEAD GIVES GREATER RIGIDITY AND ACCURACY

Here are the facts . . .

Unlike knee-type mills, the head of the IMPCo Model 1-B Vertical Milling Machine is vertically adjusted by a counter-balanced ram. The table and controls do NOT move vertically. The exclusive ram design has greater rigidity. Its larger scraped bearing surface area gives more accuracy for both production and tool room milling.

Massive Design for *Versatility* and *Precision*

The IMPCo Model 1-B is heavy for a No. 1 Mill. It weighs approximately 3,100 lbs. Spindle quill diameter is 3½". Uses *standard* 1 HP motor.

Get all the facts.
Write for Bulletin AM-102.

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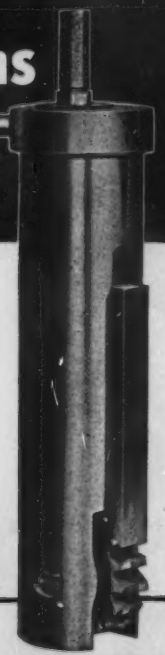
10 Good Reasons

why YOU should use NATIONAL Keyseating Millers on your next job



They will mill keyseats:

- in one cut.
- in offset holes.
- that are straight.
- with parallel sides.
- partly through holes.
- for interchangeable parts.
- without clamping the work.
- of standard width and depth.
- in holes that are closed at one end.
- where keyseating machine can't reach.

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complete, handy size

cellent business improver for, after all, the production men can be a great help in keeping a business on the profit side.

As soon as important employees in the shop realize that the profit-making success of the firm is of greater importance to their general welfare than next week's take-home pay, then they usually start to take a strong interest in economical production, put their shoulder to the wheel as the saying goes, and help to boost the company into a position of stability and permanence.

In this way everyone gains and there is a reasonable peace and quiet around the plant as well as the home—just as Al anticipated.

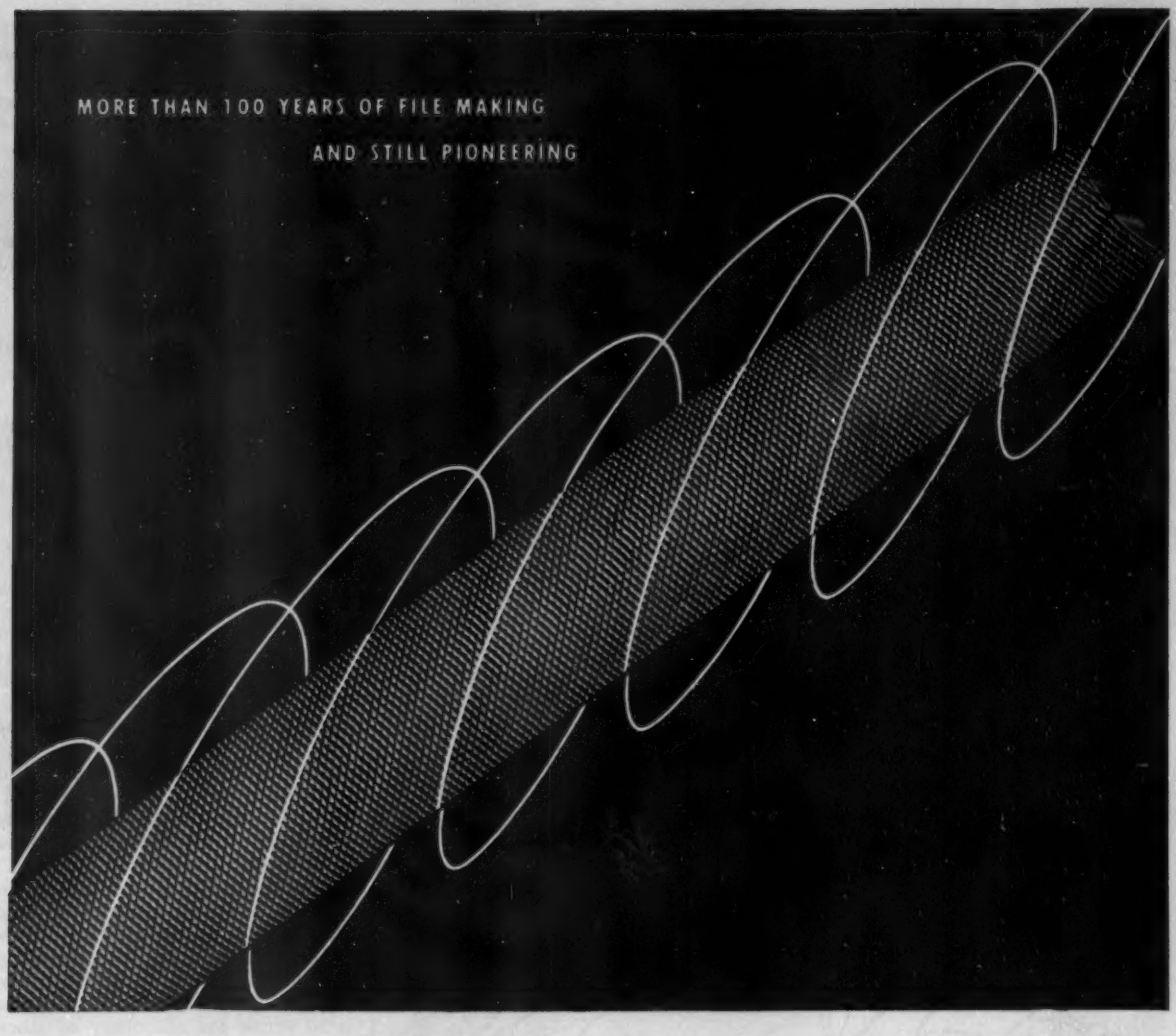
On the other hand, according to Ed's idea, the suggestion box would be open to all employees "Except Toolmakers" which not only would place the toolmakers in a position to be ridiculed, and would probably deprive the company of many valuable cost-reducing suggestions, as well as stirring up ill-feeling toward the management.

Ed had better revise his ideas a little and try again.

Somehow the "Except Toolmakers" reminds me of an incident attributed to Jonathan Swift. It appears that some society did not like Swift and so they printed on the door of their meeting place words to this effect: "This door is open to everyone except Jonathan Swift." Swift when passing by noticed this and immediately wrote underneath: "Who wrote the above has wrote it well, for the same is writ on the Gates of Hell."

George P Pearce
Albuquerque, NM

"Well, let's see how you're coming along on that blueprint for that new tool, Conway!"



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Ordinary half round files require a skillful twisting of the file to produce smooth, even work. Heller engineering has removed this human element from good file performance with exclusive Spiral-Cut Half Round Files. The necessary "rolling action" is designed right into the file. This new cutting principle is typical of Heller's continuous search for better files. By constantly testing, inspecting, improving . . . Heller guarantees file users "the best."

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- *Jiffy Tires can be changed in 10 minutes*
- *Provide 2 to 4 times more wear*
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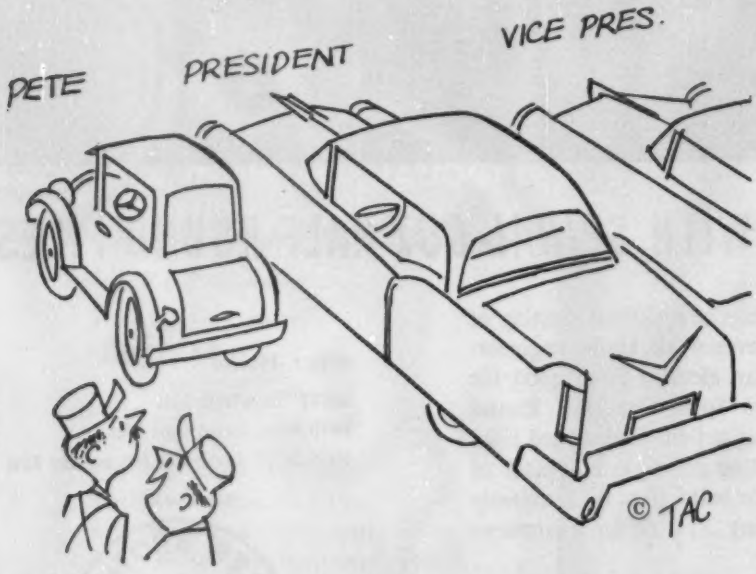
A MODERN TIRE FOR A MODERN SAW



"Pete's been close to the 'Old Man' ever since he suggested Columbia MOLITE High Speed Steel!"

COLUMBIA TOOL STEEL COMPANY • CHICAGO HEIGHTS, ILL.

Producers of fine tool steels — All types immediately available through Sales Offices, Warehouses and Representatives in Principal Cities.

TOOL COLUMBIA STEELS

can be greatly stimulated by a well-run Suggestion Plan. But it will not run itself. It must be handled consistently, continuously, and without favoritism. It can be made a great incentive to secure new ideas, to give workers an interest in their jobs, and to add to cooperation between men and management.

Fred H Colvin
Point Pleasant, NJ

NOONTIME COMMANDOS

How much importance should be attached to noontime activities? Is strenuous activity more likely to absorb excess energy, or cause a later serious letdown?

EMPLOYERS GIVE their employees time out to enjoy a few minutes of relaxation as they congregate around the coffee urn. This has proven of value in stepping up production in spite of the fact that a few take advantage of it and stretch the time out far beyond that allotted. One would think that the workers would show their appreciation by conducting themselves with a reasonable degree of moderation in activities during their noon hour.

Whether it be coffee or relaxation it makes no difference. They are both conducive to more effective performance of working time providing the relaxation isn't carried to extremes. The purpose in both cases is to break the monotony of labor and to increase their efficiency as workers. Relaxation doesn't call for the men to rush out on the lot at noon and tear their heads off racing

AIR CIRCUIT DESIGN AND COST SIMPLIFIED BY AIR CYLINDER WITH BUILT-IN VALVE . . .

In pneumatics operation the closer the valve to the cylinder, the quicker, more positive the action. In the Bellows Air Motor the valve is *integral with the cylinder.* This integral construction means instant action. No lag, no delay, no air flow restriction. Integral construction means positive control over piston rod direction . . . over piston rod speed. It means compactness — space-saving design . . . simplified installation in cramped quarters, or on moving machine elements.

Bellows Air Motors are available with a choice of built-in valve arrangements. Thus, the engineer can choose the method of valving he prefers, yet still have all the advantages of integral valve and cylinder construction. If he prefers momentary contact, low voltage control — Bellows has it. If he prefers maintained contact, 110 volt operation for simple interlock with established electrical circuits — Bellows has it. Or should his designs call for full pneumatically controlled operations Bellows offers a choice of proven control systems.

VALVE AND ALL OPERATING CONTROLS ARE INTEGRAL WITH THE CYLINDER.

WRITE FOR THIS FREE 36-PAGE BOOKLET

Here in these quick-reading pages is the story of the Bellows Air Motor—What it is doing for others—what it can do for you. No cost. No obligation. Address Dept. AM1054, The Bellows Co., Bellows Bldg., Akron 9, O.

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AKRON 9, OHIO

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...an example of cost reduction through W&S tool design...

A large electric meter manufacturer asked us to design a single small precision tool to do in one operation the work formerly done in three. The double-ended tool we made to their product specifications cost just half as much as the three tools it replaced; it reduced production time; and it eliminated multiple error along with multiple set-up.

Woodruff & Stokes specialize in small tool design and manufacture. For example, supplying small cutting tools requiring diameter tolerance of ± .0002" or closer and as many as five cutting diameters is not unusual. Woodruff & Stokes have made these tools their business.

How can W&S help you? Write today for complete information.

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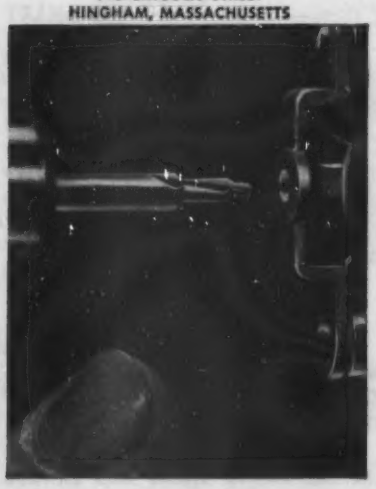


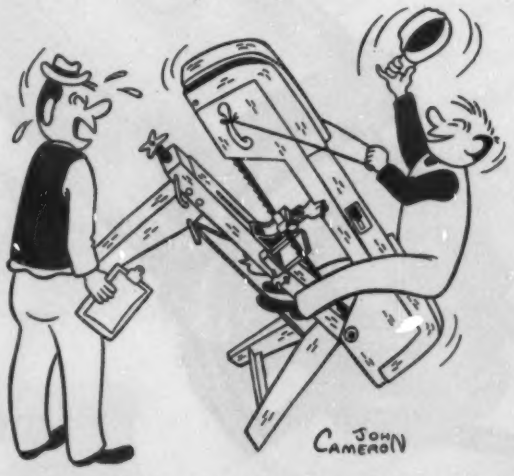
ED'S FIRST REPLY to Al shows the weakness of his side of the argument. No suggestion system pays extra money to anyone—toolmaker or machinist, for doing their *regular* work. It really isn't their work we pay for in Suggestion Plans—it's their ideas. It is the guy with ideas that will increase production or improve the product, that makes it possible for us to progress as we have in machine production. The toolmaker's work is to produce the tools the tool designer has planned to handle the work. When the toolmaker has ideas or suggestions that make work easier or cost less, he should be paid for them. It is not easy however, to set a value on ideas that may require considerable development by the engineers. But the reason we have suggestion boxes is to stimulate men to think about their work and the company. While setting a flat rate for suggestions is not always best or fair, it at least makes a starting point.

A brilliant idea may only save a few dollars on a product that is a minor item in the shop's production; a similar suggestion on products having a wide sale is worth a lot more to the firm. This is the unfairness of the flat rate for all suggestions adopted. It should be possible to devise a formula that would vary the award according to the real value of the suggestion to the company, and several plans have been tried to accomplish this purpose. Even the tool designer might well be considered eligible for financial recognition when he devises a tool or fixture that makes a substantial saving to the firm. His salary, or wage, might be considered as a retaining fee, or an annual wage, to which a bonus will be added according to the value of the tools or fixtures he designs.

Large chemical concerns, such as duPont are credited with putting young engineers to work on certain projects at a rather low starting salary. They make all sorts of experiments trying to develop a worthwhile product. If they succeed they are said to be well rewarded either by an increase in salary or a percentage of the value of the product to the company.

It would be manifestly unfair to refuse financial recognition to a tool designer who devised money-saving tools and fixtures while at his regular work. Of course he is hired to design tools for making the product. But would Ed think it unwise to recognize outstanding ability in some substantial way? Or would he simply fire the tool designer who failed to come up with especially valuable tools? As I understand the Lincoln Electric Company's plan, they reward efficiency of different kinds in a very substantial manner—and it has paid well.

One great advantage of the Suggestion Plan is that it effectually prevents Ed, or any other foreman, from claiming credit for ideas that came from men under him. This hogging of credit has been too prevalent in the past. But in many cases it was practiced because top management had the idea that it was the foreman's job to be constantly producing improved methods. New ideas and good foremanship do not always go together. A man may be an excellent foreman as to handling men and getting work out, while still lacking inventive ability in designing either new products or new tools. Ideas



"Creedly, stop playing cowboy on that bandsaw and get back to work!"

WICKES CENTER DRIVE CRANKSHAFT LATHES

with automatic feeder-unloader now rough and finish machine 20 forged steel V-8 automotive crankshafts an hour on continuous operating cycle

With the new hydraulically operated loader and unloader, Wickes Center Drive Crankshaft Lathes are now machining up to 20 forged steel V-8 crankshafts an hour on a completely automatic work cycle for several of America's largest automobile manufacturers. Here's how the machine operates: Automatic loader picks up milled crankshaft from the loading rack and loads it into center drive position, at the same time it is picking machined crank from the lathe and depositing it on unloading rack. Automatic chuck, synchronized with the loader, closes over the chankshaft as centers move into position. Lathe performs rough and finish cheeking, turning and filleting operations on all main line bearings and finish turns both flange and stub ends. This complete cycle automatically continues to repeat, until transferred to non-repeat by operator.

Wickes manufactures both main line bearing and multiple crank pin turning lathes for all types and sizes of crankshafts. Whether you're machining cast or forged crankshafts or using Tangtung or carbide cutting tools, Wickes has a lathe to fit your production.

Submit your crankshaft turning problems for detailed information.

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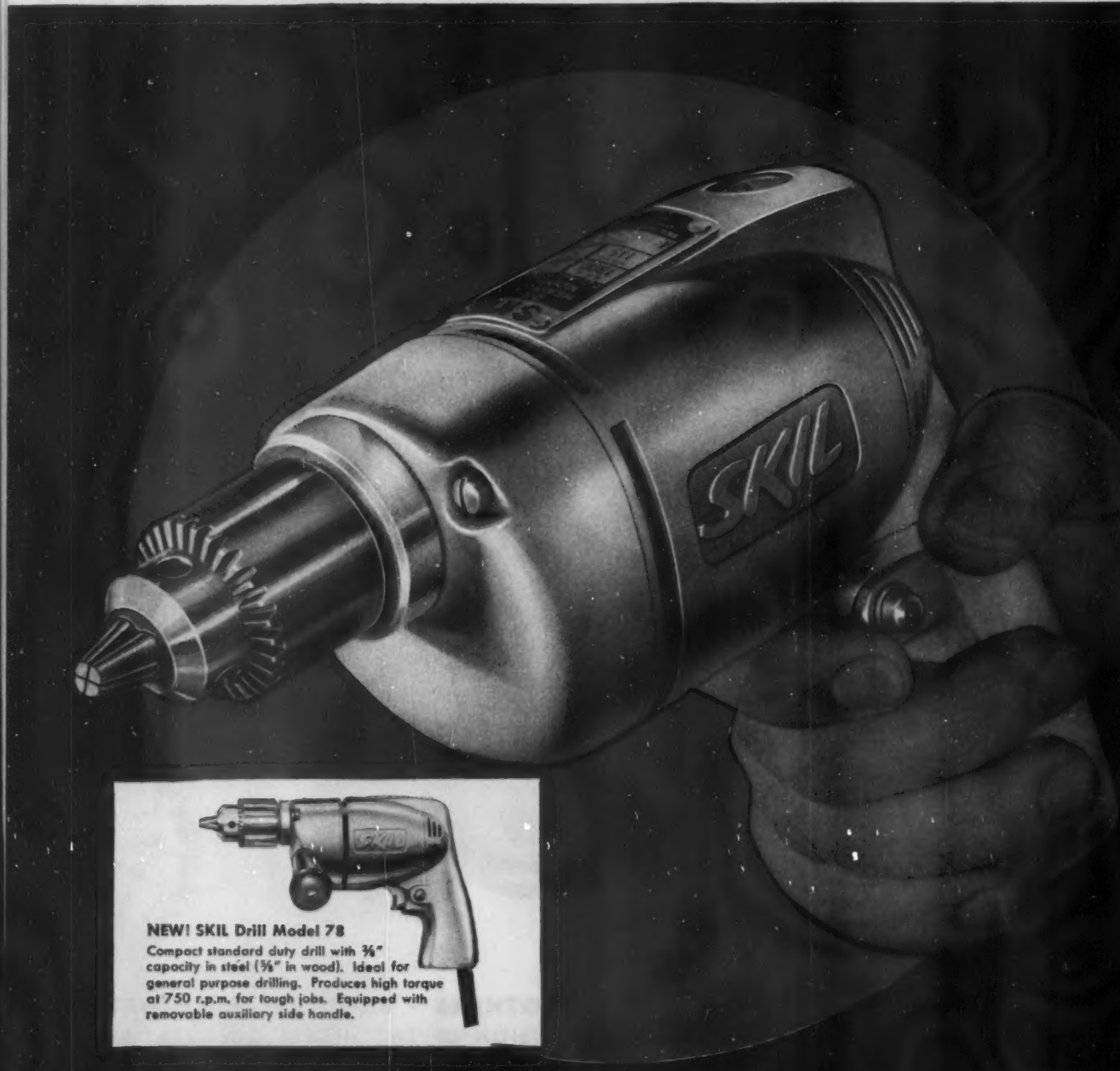
55% More Powerful, Yet

New SKIL 1/4" Model



NEW! SKIL Drill Model 78

Compact standard duty drill with 3/8" capacity in steel (5/8" in wood). Ideal for general purpose drilling. Produces high torque at 750 r.p.m. for tough jobs. Equipped with removable auxiliary side handle.

Lighter in Weight!

75 Drill

More Rugged! More Comfortable in Use! Cuts Costs! Easier to Operate! More Efficient! Boosts Production!

Just one trial of this new SKIL drill will prove its advantages to you: For here's a husky, heavy-duty drill that's 55% more powerful while it's actually *lighter* in weight!

In the SKIL Model 75 you'll find really outstanding performance combined with top operating power, longer operating life. A choice of 7 speeds available, from 500 to 5,000 r.p.m. . . . depending on your individual work needs. Capacity: ¼" in steel, ½" in wood. Have your distributor show you the SKIL "75" now!

Look Over These Important Features!

- All anti-friction bearings—for greater efficiency and low maintenance.
- Motor 55% more powerful, yet lighter than previous model.

- Handy, safety-designed trigger lock for continuous operation—side location for easy operation.

- Larger inspection plates easily removed for checking and cleaning.

- Contour-fit handle for easier and more comfortable handling.

- New molded rubber strain relief—protects cord against fraying or breakage at drill cord attachment joint.

- Convenient chuck key holder on cord.

SKIL

FREE!

Send coupon! Let your SKIL Distributor prove to you—with a remarkable demonstration and free trial—that "SKIL is the answer" to your production bottlenecks!

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☐ I would like a demonstration and trial . . . FREE!
☐ Please send me illustrated literature on SKIL Drills!

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In a four month period under actual competitive conditions one Diamond Wheel ground 36,976 pieces, while eight silicon carbide wheels ground a total 16,023 pieces.

RESULT— 1. Less cost per piece 2. Greater Production 3. Less down time.

See for yourself how

SECOMET DIAMOND WHEELS

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Send for informative catalog #54 or contact us direct for information and assistance.

J. K. SMIT & SONS, INC.

MURRAY HILL, N. J.

around the lot chasing a ball. One can play healthily and derive considerable benefit therefrom.

Certainly some kind of change is advisable for the worker. It is good for him to have some kind of activity, but this should be in moderation. Different types require different kinds of relaxation—the hard worker should take advantage of his noon hour by resorting to complete relaxation. Here is one thing wherein the employer has fallen down on the job. When a man is "pooped" he needs a comfortable place to lie down for fifteen or more minutes in order to rest his over-strained body.

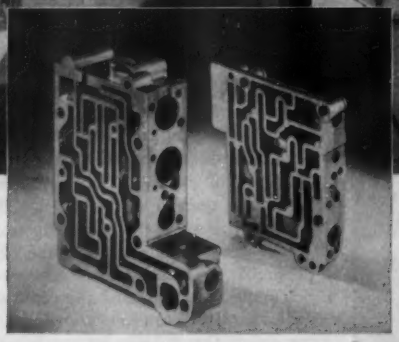
If I were an employer I would spend some of my time in meditation on ways and means of making my employees as comfortable and happy as expenses would permit. Maybe I am too far away from civilization to know just what is going on along these lines, but I'll wager my best putter that few, if any, plants about the country have a rest-room for its workers to drop in for a few minutes' real rest—with the sanction of the supervisor, of course. I don't mean a sitting rest by any means, but a real, honest-to-goodness couch whereon a man can flop and pass out in complete relaxation.

It is not my purpose to influence any employer in establishing a dormitory or flop house for his workers, but I do appeal to their sense of justice in making it possible for his men to really relax when occasion warrants them to do so. There is no doubt that such a thing would be abused if not properly supervised—just as the coffee time is taken advantage of. There are some who would need an alarm clock to arouse them so that they would not snore their tonsils loose for the remainder of the day.

I've seen these noon-hour baseball sessions go on day in and day out, the boss taking part in them, and, after the bell called them to labor, the wrangling and arguing would stretch out for an hour or more. Not only that, but the men would not be fit to carry on their work. Workers have to relax and in so doing will go overboard in their efforts. Why the plant as a whole should suffer because a few are thoughtless is a question for the violators to ponder over, and if any sense of fairness exists, they should see that they are imposing a burden on all.

Take it easy, you noon-hour hell raisers, and gain the real benefits of relaxation. You'll live longer by doing so.

Rex Warren
Waterloo, Iowa



Holes on extremely close centers vary in diameter from 1/16" to 13/16". The valve body has 33; the cover, 18.

"—BUT OUR PRODUCTION RUN IS LIMITED."

"SO WAS THE RUN ON THIS AUTOMATIC TRANSMISSION PART, BUT". . . .

HERE'S HOW ZAGAR TOOLING SAVED MONEY HAND OVER FIST

This aluminum die casting is processed in its entirety by Zagar planning, except for milling two faces. Two lines of Zagar standardized self-clamping drill jigs ream, tap and drill both valve body and cover. With 24 heads and 24 fixtures, Zagar performs work on 51 holes on close centers. Step tools take care of reaming and burnishing. The fixtures were designed to compensate for slight inaccuracies in the die casting. Thus has Zagar engineering solved an acute problem of limited production without the purchase of costly special machines.

Ask on your letterhead for Bulletin "A-10."

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Newest addition to MILLERS FALLS famous line of cost-cutting tools for industry

This rugged, high-production tool cuts sheet metal — up to 16 gauge (.060") in steel and galvanized sheet — up to 50% greater in aluminum, copper and other non-ferrous metals. Blade adjustments for different jobs are quickly made — with hex keys conveniently located in tool handle.

In power, in quality, in design, the new No. 16 Portable Electric Shear is an outstanding addition to Millers Falls line of electric tools for production and maintenance . . . including drills, high-speed die grinders, heavy-duty grinders, saws, hammers, sanders, polishers, screw drivers and nut runners.

On straight lines or curves, from inside or outside, Millers Falls new No. 16 Portable Electric Shear cuts clean and fast. Light weight — only 8 lbs. Minimum radius for left hand cuts is ½", for right hand cuts, 1¼". High cutting-line visibility. Precision-ground, heat-treated alloy steel blades are quickly removed for resharpening. Built to Millers Falls quality standards, the No. 16 Portable Electric Shear is the latest star in a notable line of industrial electric tools.

Compare the features

Write for free literature on the new Millers Falls Shear, on Millers Falls complete selection of high-performance, advanced-design electric tools. Demonstrations will be quickly arranged on request.

MILLERS FALLS COMPANY
Dept. AM-4, Greenfield, Mass.

MILLERS FALLS TOOLS
SINCE 1868
The Mark of Superiority

I DON'T THINK NOON-BREAK GAMES will significantly lower production figures unless the wrong people engage in them. This is not likely because most people take the kind of exercise which their physical and mental states dictate. Middle-age and over would be quite unlikely to indulge in strenuous games even of an evening, at week-ends, or on holidays, not to speak of during the mid-day break for lunch. In the main, nature seems to be quite good at arranging those matters. To my mind, Al would seem to be making a mountain of a molehill here.

Since Al refers to baseball, I take it the players will be young or, at least, youngish men with a superfluity of energy to work off. If my assumption is correct, no great harm should come to them personally and output should not be in any great danger. I think Al and those of us of Al's generation get so caught up in this production whirl, so self-centered, so recluse from the lighter, brighter side of life, that we are in danger of being unable to see the radiant wood for the trees. This is a mistake and will certainly not promote teamwork nor increase production. It is also a challenge, what I call the challenge of the groove. At all costs, advancing years must beware of the danger of getting into a groove.

After watching teams of our "under thirty's" literally mowing each other down in thirty minutes of noontime football, stripped to the waist, in long pants and iron-shod footwear, I sometimes find myself wishing they'd devote to their day's work something of the energy they let loose on the playing field. That is irrational thinking, of course, since they could not maintain the terrific football pace for eight hours even if they would; moreover, none of the factory operations calls for such an outpouring of physical effort.

If carefully chosen, relaxation will improve the mental and physical condition and when they are robust, production will share in the general well being, of which high morale is a consequence. *Choice* of relaxation is what matters most. A forger working a heavy hammer would be ill-advised to relax at baseball or football during the noon break. A game of billiards would be more of a relaxation for him.

I have never known a case where workers have so physically exhausted themselves playing games at the noon-break as to be unable to return to the afternoon stint, although I have often wondered at their physical resources and endurance. Look-

ing back, I feel there is an age when we humans take a lot of punishment without any apparent ill effects.

For example, I began to serve my apprenticeship at the age of fifteen; rose each morning, including Saturday, at four-thirty, prepared and took some food and set out to walk four miles across country for a 6 AM start at the shipbuilding yard. During winter I attended the technical college three nights per week, arriving home on foot at 10 PM, a wash, some food, and so to bed to prepare for a 4:30 rise next morning. I did that for six years, played football on Saturday afternoons in winter, worked in an occasional night's skating on my "free" evenings—evenings when I did not attend the college. I also took in a few dances which, in the country, were always arranged for full moon so that we could see our way home, on foot, from the dance in the early hours. In summer, golf, cycling and swimming filled my free time, none of them on Sunday; as befitted a strictly brought up Scottish Presbyterian, I attended divine worship twice each Sunday all the year round.

Modern youth would probably shy at such a program, yet, today, some 50 years later, I cannot say the experience either exhausted or daunted me. I cannot truthfully say I have suffered in any way from the pace I then set myself; it was regarded as quite normal among country youth.

Applied to, say, "under thirty's" I feel this is a highly overrated view of what I do not regard as a problem at all. It could be regarded as a blessing, working off—on the men's own time—accumulated excess of energy which the physical demands of their job do not fully absorb.

If not skimmed off at baseball or some equally strenuous game, this excess energy might erupt in horseplay during working hours. Safety engineers, with an eagle eye on accident incidence, would probably heave a sigh of relief on seeing their dynamics dissipated on the playing field rather than in the factory among moving machinery.

Al, from the production angle, may take a more pessimistic view but, all things considered, I feel he is making the most of the matter. I hold that no man feeling in need of rest would deliberately embark on half an hour's rough-house.

I am certain that physical condition is the deciding factor and that the company lucky enough to be employing large numbers of such men is to be congratulated.

PEARLITIC MALLEABLE CASTINGS

If service conditions are unusually rugged and you're troubled by high manufacturing costs—look to pearlitic malleable castings!

Pearlitic malleable has high fluidity that casts easily into complicated shapes. It resists wear under heavy loads at high speeds . . . has high ultimate strength . . . possesses excellent non-seizing properties for bearing surfaces . . . can be given a very smooth finish where desired . . . and can be either liquid quenched or air quenched. And perhaps *most important of all, pearlitic malleable machinability index ranges from 80 to 90* (B1112 steel = 100).

So look your product over critically. Then check pearlitic malleable castings. They can replace more expensive methods of fabrication or manufacture . . . can lead to reduced weight, less machining time . . . fewer assembly operations . . . *greater sales appeal for your product.* AA-168

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HOLE PUNCHING and NOTCHING UNITS

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. . . these cumulative savings result in a substantial lowering of per piece part cost. And, in most cases, Toolset Units permit you to render faster service . . . a bonus feature in better customer relations.

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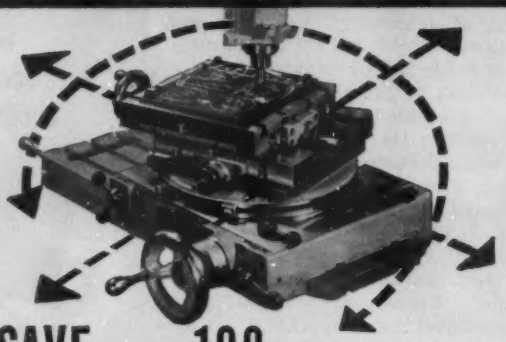
CROSS-SLIDE ROTARY TABLE



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*Proved by our customers! Hours saved in comparison with time needed to do job on standard vertical milling machines not equipped with table.

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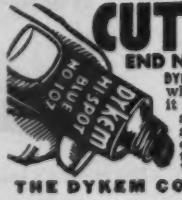

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ROME CABLE CORP. SAYS:
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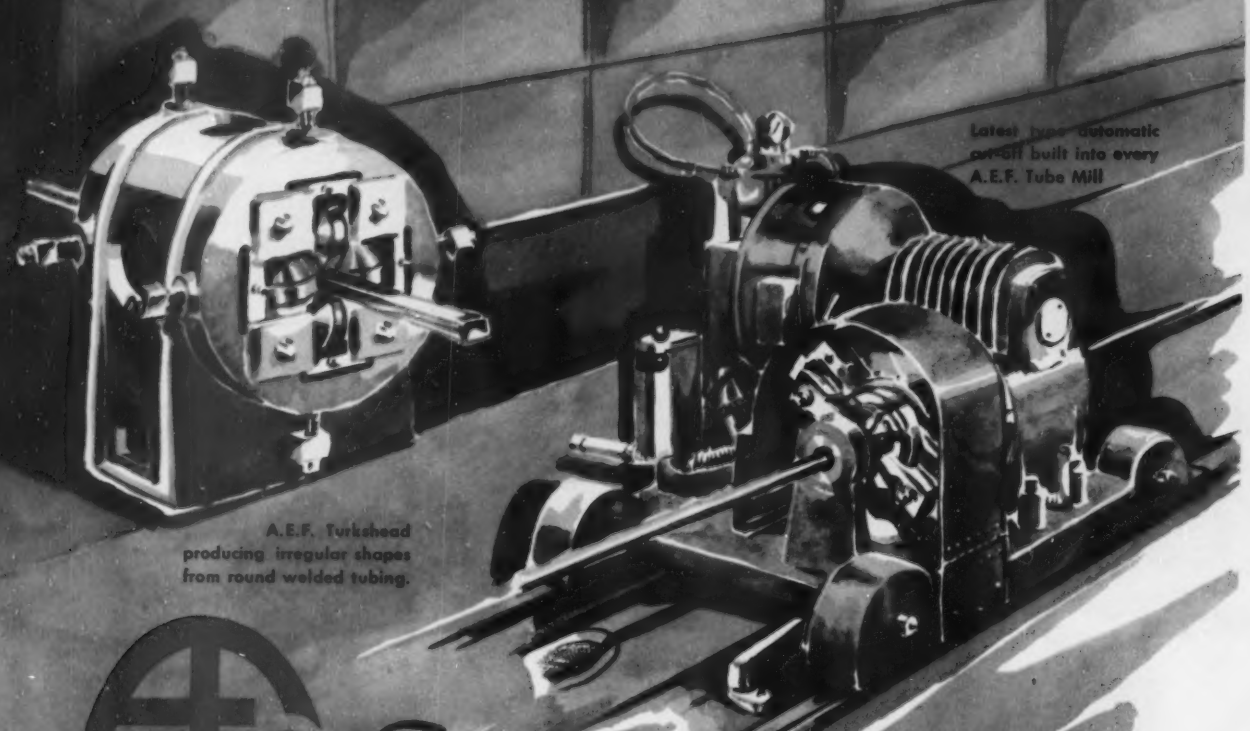

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A.E.F. Turkshead producing irregular shapes from round welded tubing.

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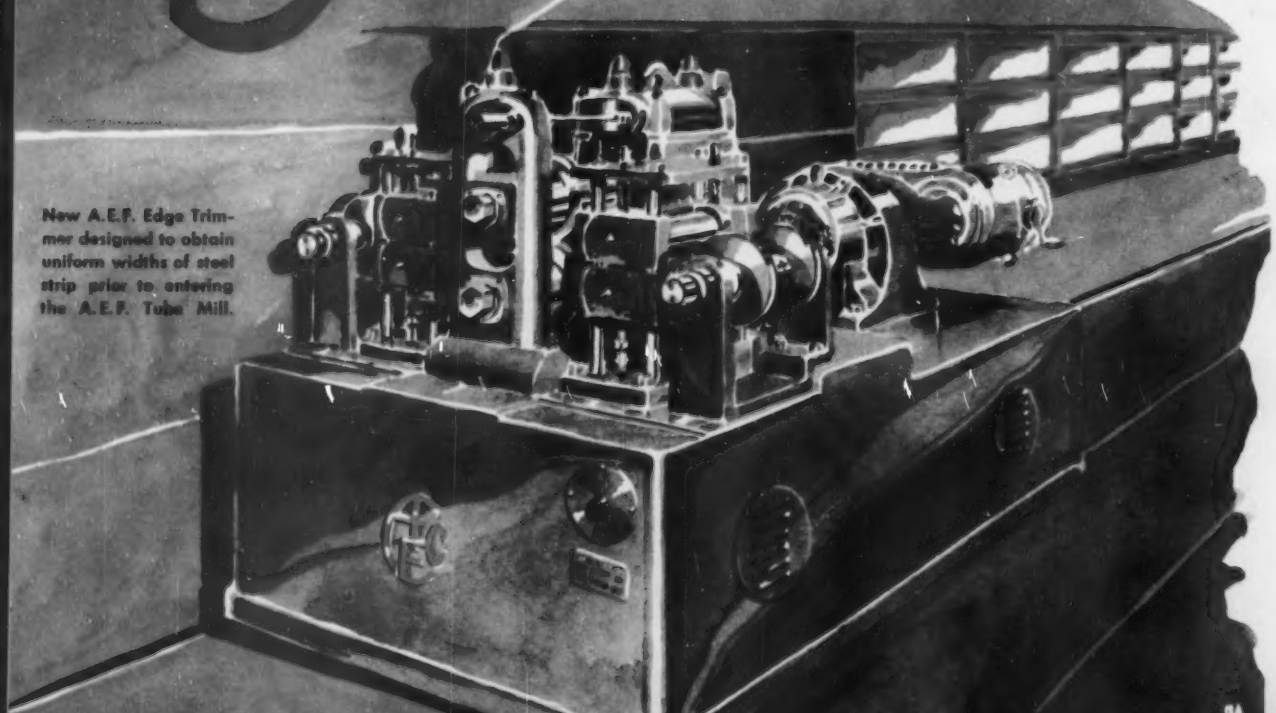

New A.E.F. Edge Trimmer designed to obtain uniform widths of steel strip prior to entering the A.E.F. Tube Mill.

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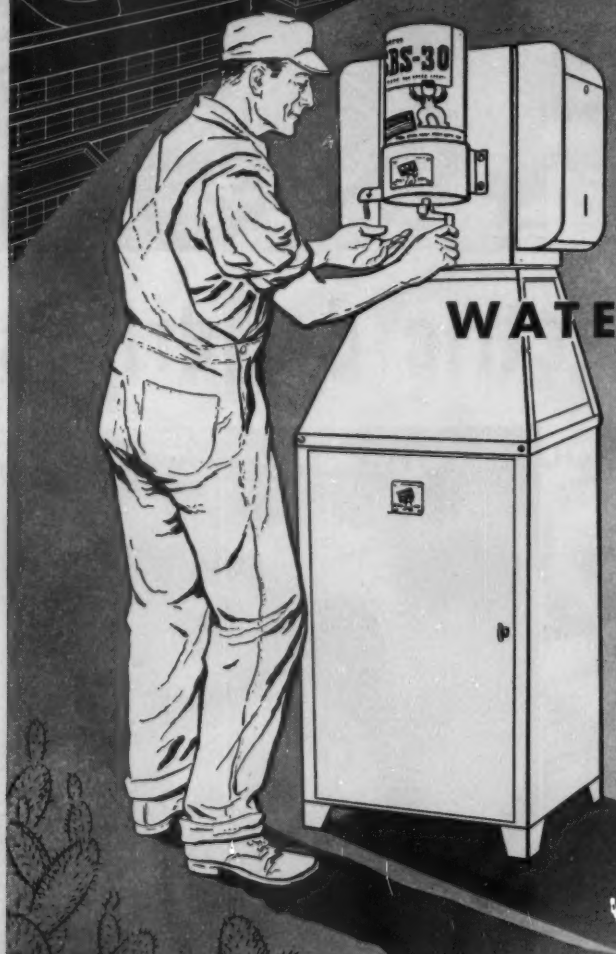

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WATERLESS SKIN CLEANSER

You'd recognize many of them "right off the bat"—leading industrial plants that have tested, proved, ordered *and reordered* increasing quantities of SBS-30 Waterless Skin Cleanser.

Today, as you read this, more than 2000 plants are saving workers productive time . . . licking seemingly impossible skin cleansing problems . . . and vastly improving employee relations through the magic of SBS-30 Waterless Skin Cleanser.

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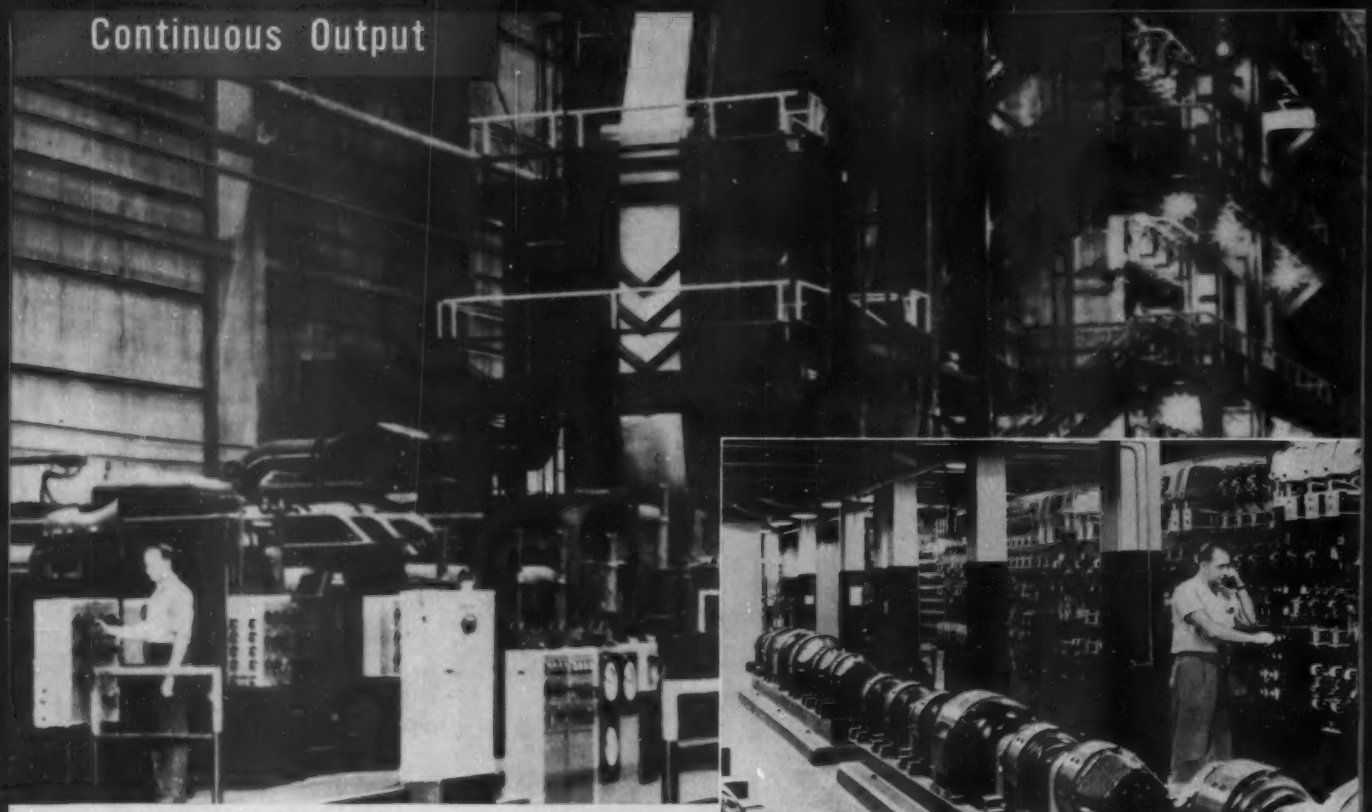
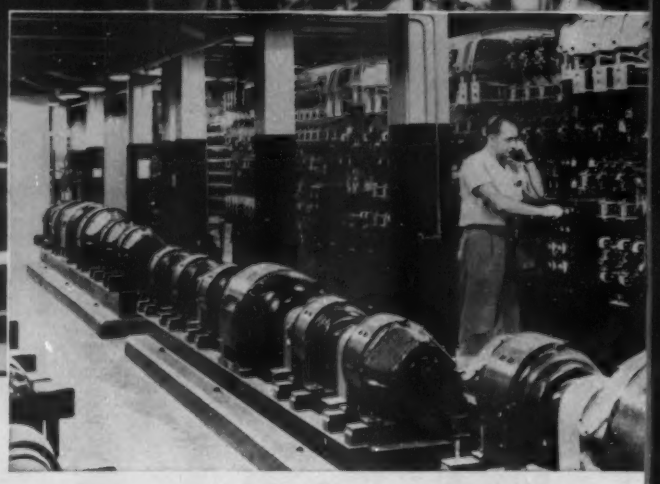
Continuous Output

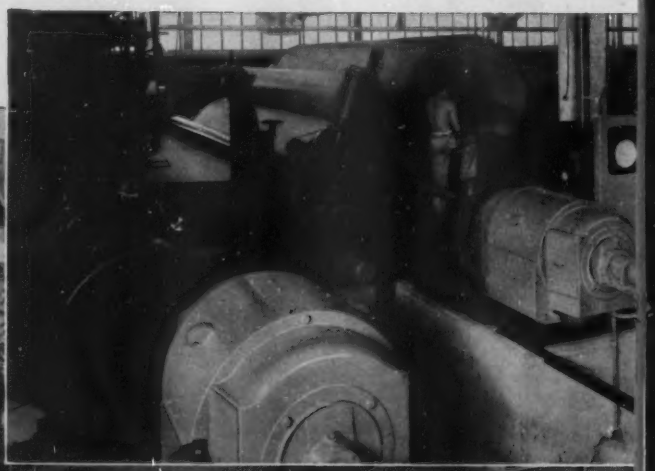


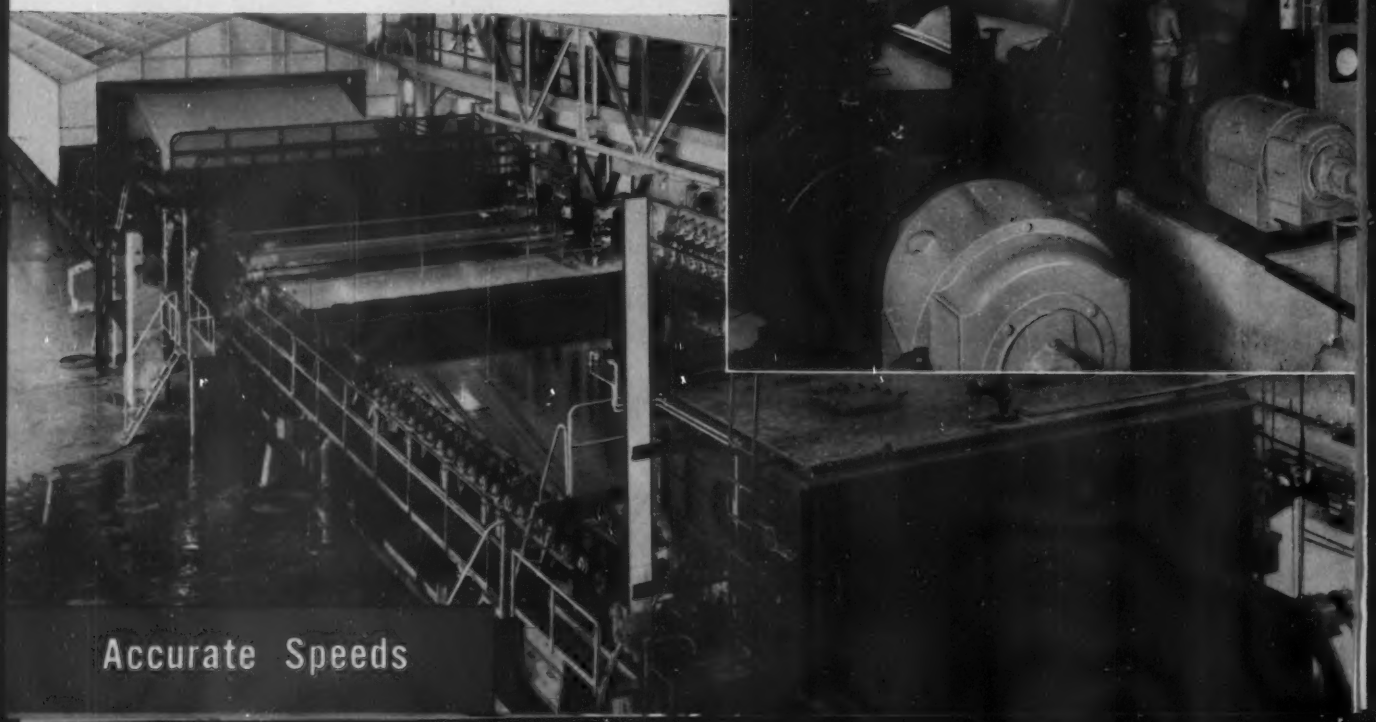


Co-ordinated G-E drive and furnace help produce up to 30 tons/hour of annealed strip. Adjustable voltage d-c generators co-ordinated by modern control provide smooth, fast, precise operation.

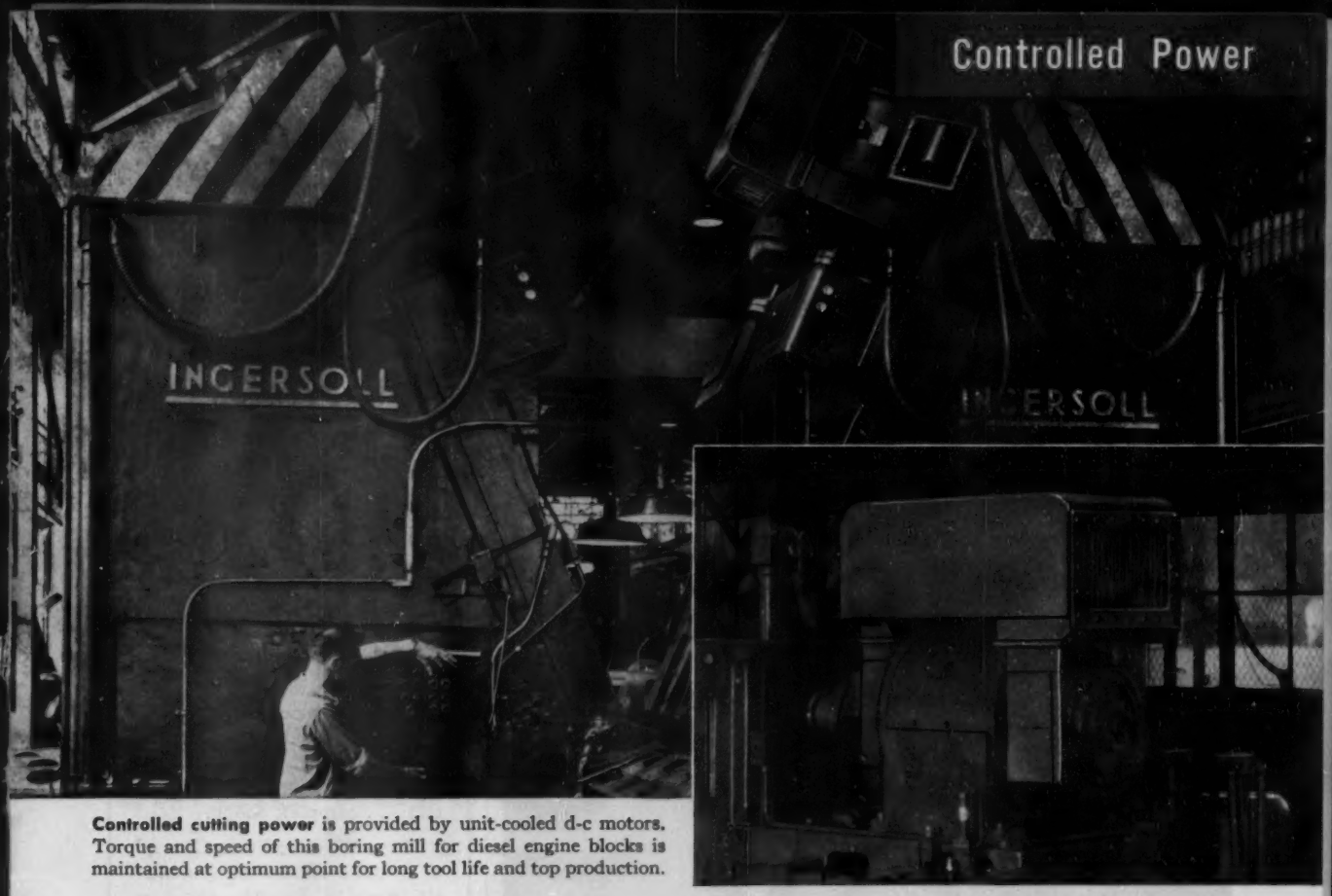
How General Electric d-c drives

Accurate speed from d-c drive co-ordinates sections of paper machine into fast flow of production—up to 300 tons/day. Mechanical design of machine is simplified, output increased.





Accurate Speeds



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DC MOTORS STEP UP PRODUCTION THROUGHOUT INDUSTRY

DC drives give you precise control of torque, speed, and power —essential in automatic production. The degree of precision depends on the steady performance and continuity of service of d-c motors and generators. In applications requiring close speed regulation, quick reversing, severe peak loads, G.E.'s complete line of Type CD-1000 motors is:

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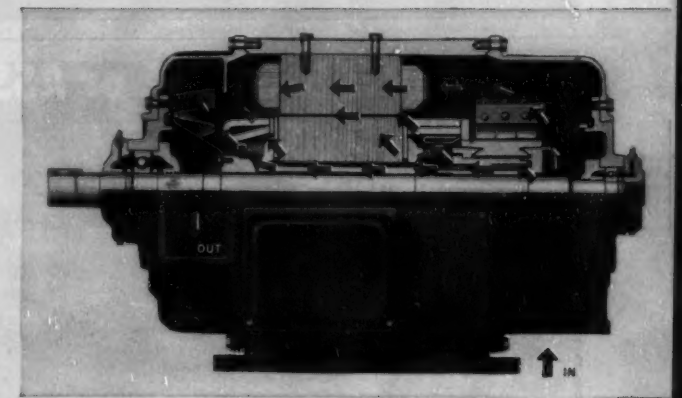

Excellent ventilating system gives positive ventilation to entire motor. Shaft fan on armature helps dissipate heat, keep within specific temperature rise.

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PRESS to *tap, gauge* or *assemble* — PULL to reverse. Thousands of these compact friction drive machines are finding new uses. Reverses 40% faster. If you hit a hard spot, driving friction slips to warn you to back up, clean away the chips, and make a new start.

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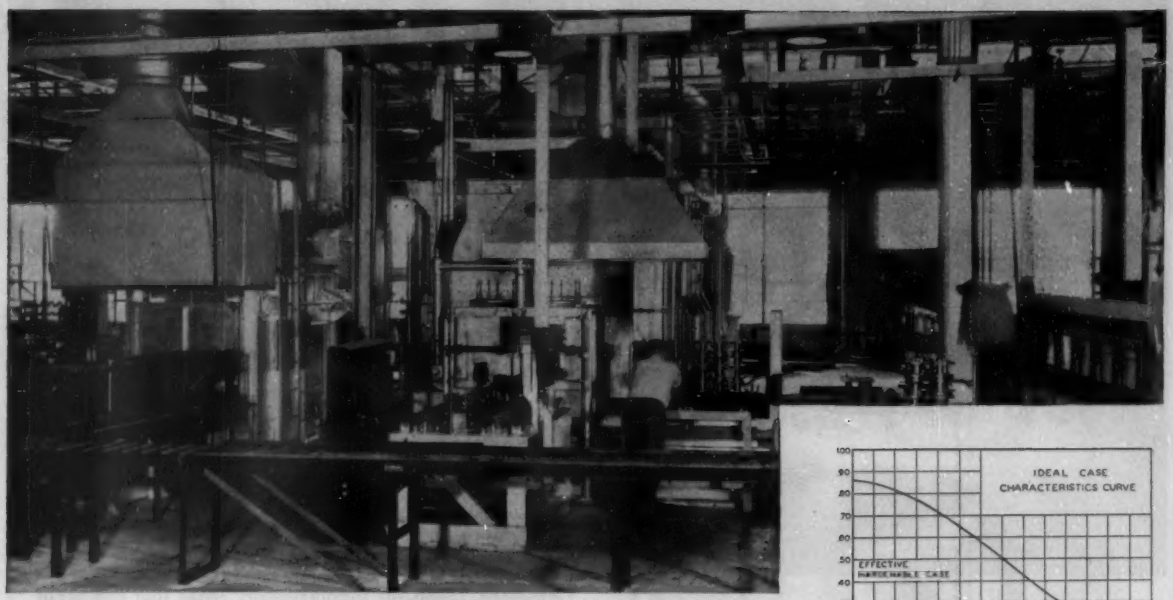

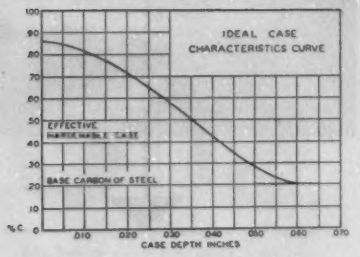

on the nose every time

WITH SURFACE AUTOCARB AUTOMATIC CARBON POTENTIAL CONTROL

New high physicals in carburized gears—better tooth-to-tooth and gear-to-gear uniformity—faster cycles—automatic compensation for changes in work surface area during furnace operation . . .

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It takes the right machinery to build your product right! Columbus Die-Tool individually designs and builds tools, dies, and special machinery to produce your product alone. This gives you the advantages of lower operating cost, greater production and a higher quality product.

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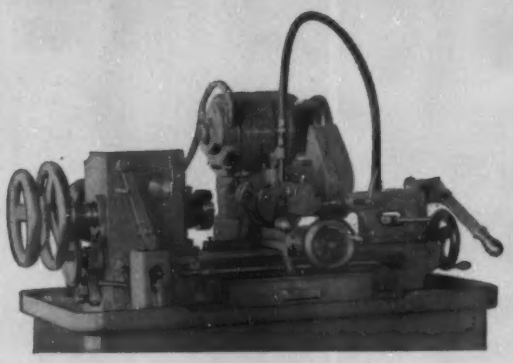
JIGS • FIXTURES • BUILDING MACHINE TOOLS COMPLETE
SPECIAL TOOLS • UNITS FOR MACHINE TOOLS

IMPROVED THREAD MILLING
WALTHAM MACHINES



Several improvements in design have recently been made that are not mentioned in our descriptive bulletin. Send for supplementary sheet that lists these improvements and presents an illustration of the whole machine.

WALTHAM MACHINE WORKS, INC.
HIGH STREET, WALTHAM, MASSACHUSETTS

NOT This — But This

When Your Punch Press Operators Use

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Patented

PREVENTS INJURY — Saves Glove Costs. Feeds ferrous, non-ferrous strip or sheet . . . faster, safer. Use for stamping, shearing. Right or left hand non-slip fitted grip, self - adjusting. Sturdy hardened work surfaces.

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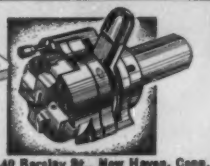
H&C Insert Chaser DIE HEADS



famous for accuracy and straightness of threads, low chaser costs, less downtime, more pieces per day.

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Pacific Coast Representative: A. C. Behringer, 554 N. San Pedro St., Los Angeles, Calif. Canada: F. F. Barber Machinery Co., Toronto, Can.

Surface, Lapping, Layout Plates, Angle Plates, Boring Mill Angle Plates, Tool Steel and Regular Steel Parallels, Parallel Straight Edges. Medium and large size V Blocks sold only with Surface Plates.

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Here are bevels and spurs for a reeling machine and bronze helical gears for a 60" hot-strip mill. They're Stahl-made, which means they are made right, of the finest materials—fit right for long, economical service. For gears in any size, any quantity, promptly delivered—get in touch with Stahl.

SPURS TO 72" PD, 1 DP
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Make a comparison test . . . Grant stock gears against those you now use. You'll find Grant Gears more accurate, uniformly the same, whether you use two or two hundred.

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AGMA

The full Grant line is described in the new catalog recently issued. Write for your copy today!

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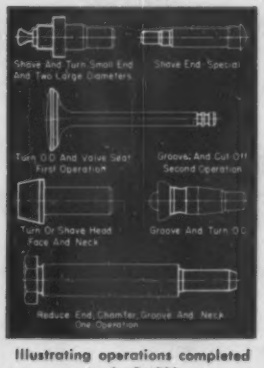
Founded in 1867 by George B. Grant the Pioneer Gear Man

ECONOMY Automatic Shaving Machines
FOR LOW COST, FULLY AUTOMATIC—HIGH PRODUCTION

Typical parts machined on the "LS"-3600


Shave And Turn Small End And Two Large Diameters
Shave End Special
Turn O.D. And Valve Seat First Operation
Groove And Cut Off Second Operation
Turn Or Shave Head Face And Neck
Groove And Turn O.D.
Reduce End, Chamfer, Groove And Neck One Operation

Illustrating operations completed on the S-4300

THE ECONOMY LINE

Automatic Shaving Machines
Automatic Pointing Machines
Semi-automatic Pointing Machines
Automatic Pointing & Threading Machines
Automatic Pointing & Shaving Machines
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ECONOMY Automatic Shaving Machines are designed to perform facing, turning, grooving, necking, cut-off and burnishing operations on bolts, automotive valves, projectiles and similar parts.

They are available in two sizes—the "LS"-3600 for body diameters up to 1/2" and lengths under heads from 1/2" through 4-1/2"—the S-4300 for body diameters up to 1" and lengths 3/4" to 6" under heads. Production rates for the standard "LS"-3600 range from 800 to 2400 finished parts per hour and the S-4300 from 450 to 1800 per hour.

Machines are fully automatic and parts flow from hopper to work pan. Simple adjustments plus easy, rapid set-ups enable operator to operate several machines.

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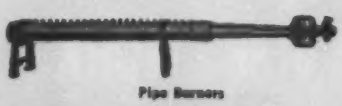
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What do *you* want to know more about?

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Whatever the subject . . . if it is concerned with the production of better metalworking products at lower costs . . . you will probably find many sensible, helpful answers and suggestions in one or more of *American Machinist's* Special Editorial Reports. There is one in every issue of this magazine, and over 60 of our previous Special Reports are available now in reprint form.

Send for a list of reports currently available. Write to our Reader's Service Department at the address below.

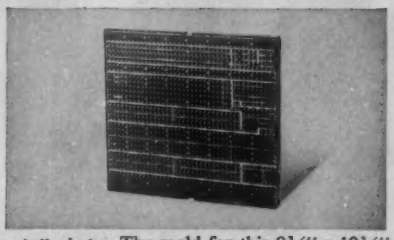
American Machinist
McGraw-Hill Building
New York 36

Make Sure You're Not Missing These Tooling Advantages!

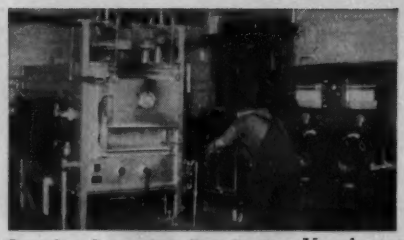
Make this *3-Minute Check* . . . Discover how a *modern* die steel can give you diemaking and production advantages no other steel offers you!

Are you aware of how tool and die steels have been improved in the last 5 to 10 years? New steels are now available that handle easier, run longer between grinds, bring down diemaking costs. Here are facts about *Vega* (Air-Tough) Die Steel—just one steel in Carpenter's Matched Set of 12 modern die steels. Compare *Vega* and what it offers, with the die steel you're using. Check it point by point. You'll see what a difference a Carpenter Matched Tool and Die Steel can mean to *your* production and profits. THE CARPENTER STEEL CO., 109 W. Bern St., Reading, Pa.

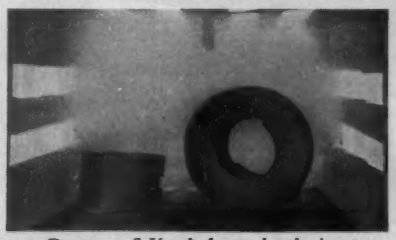
Here is what *Vega* gives you . . . *COMPARE* it with the die steel *you* use . . .



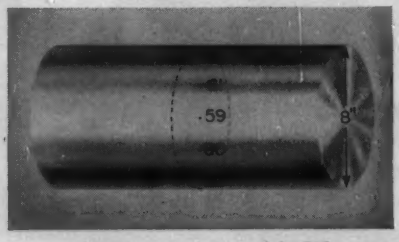
Freedom from Size Change in Hardening. The mold for this 9½" x 10½" plastic control panel has 1,280 ⅝₄" dia. holes, six ⅜" dia. horizontal ports for heating and cooling, plus eight ¾" dia. tapered holes on the edge. *Vega* was the *only* steel of many tried that could successfully hold the close tolerances of .0002" on centers of the 1,280 holes! Will the steel you use behave in hardening like this?



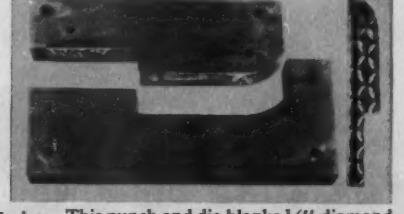
Easy, Low Temperature Heat Treating. You heat treat *Vega* from a temperature of only 1550°F (actually 200°F *lower* than the 5% chromium air-hardening grades!). No need for special, high temperature furnaces! Are you getting the benefits of *low temperature* heat treating from the air-hardening steel you use?



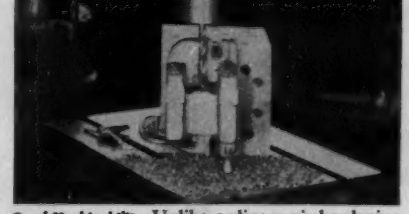
Extra Economy in Hardening. Because of *Vega's* lower hardening temperature, troublesome pack hardening to avoid excessive scaling is usually unnecessary. Does the air-hardening steel you use give you this *extra economy* in hardening?



Uniform Deep Hardenability. *Vega* gives you the advantages of uniform, deep hardenability in very heavy sections. For example, *Vega* hardens to Rockwell C-60 from surface to center in sections as large as 8" round. How does the steel you use compare on this score?



Toughness with Good Hardness. This punch and die blanks ¼" diamond threshold plates at one stroke. With previous air-hardening die steel, tools chipped and broke before any real production was made. With *Vega* these tools are in regular production—and there are no signs of wear or chipping to date. Will the steel you use perform in service like this?



Good Machinability. Unlike ordinary air-hardening grades, *Vega* has a well balanced analysis with a small percentage of hard-to-machine alloys. Field tests prove it to be one of the easiest of all air-hardening grades to machine. If the air-hardening grade you use fails to provide this *good machinability*, you're missing out on lower costs.

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Matched Tool and Die Steels

the standard tool steel of industry

. . . *modern* die steels engineered to meet *today's* requirements!

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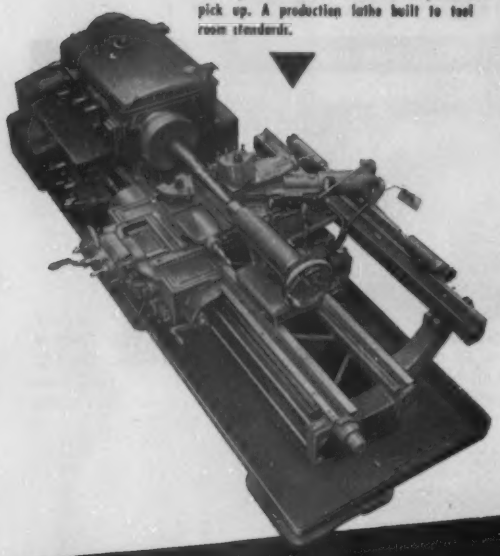
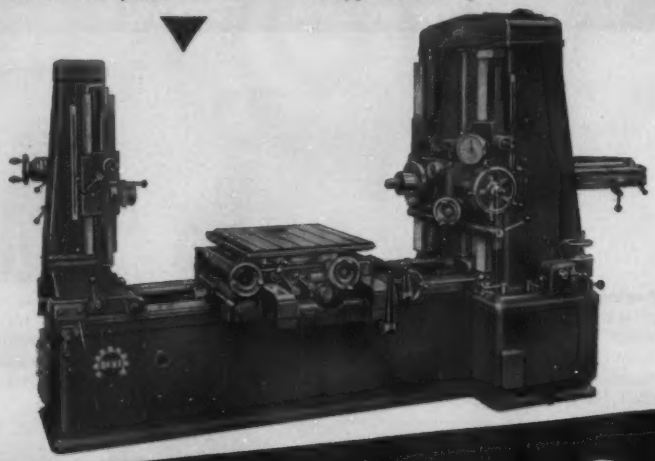
SCHAERER MODEL UN-450 HEAVY DUTY COPYING LATHES. Twin cross slides. Copies from cylindrical or flat template either longitudinally or cross. Twin slides permits rough turning and finish turning in the same operation in many instances. Swings 17¼"-20-5/64" over bed, 9" over carriage. Center distance 60". Spindle speeds 31.5 to 1400 R. P. M. Hydraulic copying attachment can be removed to permit use as a regular twin slide lathe when necessary. 10 H.P. motor drive to spindle. Separate motors for coolant and hydraulic pick up. A production lathe built to tool room standards.

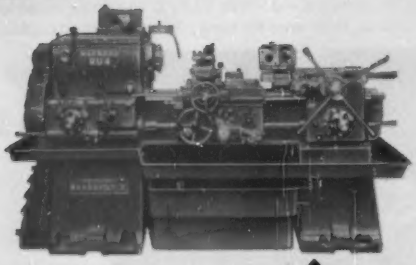


DIXI 60 COMBINATION HORIZONTAL BORING MILL AND JIG BORER WITH FIVE OPTICAL MICROSCOPES. Headstock, column, table settings accomplished by optical microscopes to insure overall accuracy of ± .0001". Built in rotary table also equipped with optical microscope for accurate angular settings. Table size 28¾" x 32⅝". Maximum distance table to spindle 19.7". Table travel—Longitudinal 23⅝"—Transverse 22¾". Hydraulic feeds for all functions 0– 78" per min. #40MM Taper spindle. Spindle travel 24.4". Spindle speeds 32-1350 R.P.M. Spindle feeds .0015"-.010" per rev.

New accessory precision circular dividing table considerably extends the range and advantages of the Dixi 60 by combining on one machine all the advantages of a horizontal boring mill with jig borer accuracy.



SEE THESE MACHINES



MAXHOVO MODEL RU 4 UNIVERSAL TURRET LATHE. Swing over bed 16-9/16". Swing over cross slide 9⅞". Capacity through spindle 2". Maximum distance spindle nose at face of turret 29½". Spindle speeds 64-1230 R.P.M. 8 power feeds to carriage .002"-.024" per rev. and 32 power feeds to turret .0005". .048". 8 or 12 H.P. motor drive. Machine can be furnished with air chuck, collet chuck, or bar feed attachment. The hexagon turret faces are machined and tapped to American standards and will accept standard turret tools of leading American manufacturers of this type of machine.

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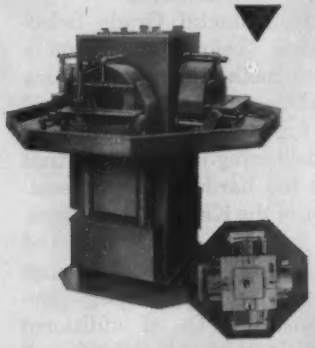
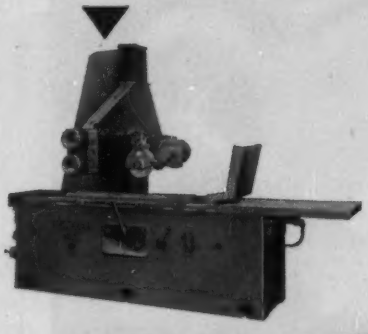
MBI

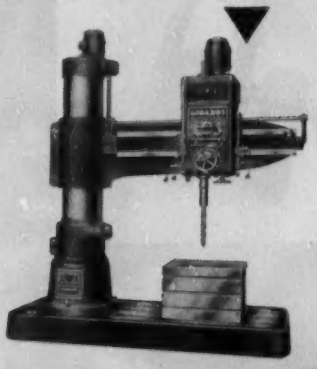
QUART CARBIDE TOOL GRINDER. 4 working positions. Three 12" silicon carbide cup wheels and one 14" straight wheel. Individual direct motor drive and separate control switch for each working position. Wheel speed 1750 R. P. M. Provision for diamond dressing tool at each working position. MODEL TRIAX (not shown) same as below, but with 3 cup wheels and 3 working positions only.



SCHNEIDER HYDRAULIC UNIVERSAL HORIZONTAL SURFACE GRINDING MACHINE TYPE JoH. Grinding spindle adjustable through any angle from 0° to 90°. MODEL JoH1, 24" x 10" Table, 18" Under Wheel. MODEL JoH2, 48" x 16" Table, 22" Under Wheel. MODEL JoH3, 60" x 20" Table, 22" Under Wheel. Table feed infinitely variable 0-60 ft. per min. Traverse feed infinitely variable 0-.600".



GIRARDS RADIAL DRILLS. Seven Sizes from 3' arm x 11¾" column to 10' arm x 25½" column. 3' and 4' arm machines have 12 spindle speeds from 32-1400 R.P.M. and 6 feeds from .0015" to .040" with #4MT Spindles. Larger machines have 21 spindle speeds from 14-1400 R. P. M. and 12 feeds from .0008" to .080" with #5MT Spindle and 7.5 H.P. Spindle Motor.



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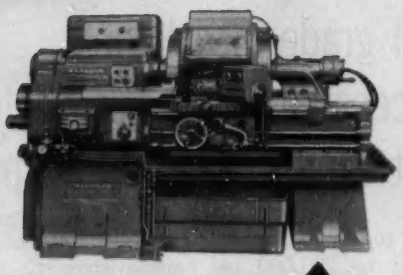
*Practically Every Machine Above.



MAXNOVO MODEL A AUTOMATIC CYCLE "PROFILMATIC" DUPLICATING LATHE. 17" swing over ways, 4½" over across slide with 20", 30" or 40" center distance. This machine is equipped with air chuck and air tailstock to provide a completely automatic cycle with 2 or 3 automatic spindle speed changes and 6 or 12 automatic feed changes. Automatic speed and feed changes are accomplished by an automatic cycle control bar which is pre-set to operate precision microswitches at any point of the operating cycle. Copies from master template mounted at rear of machine out of the way of chips and coolant. 12½ or 15 H.P. drive. This machine can be furnished with complete tooling to produce parts in accordance with your blueprint.

MBI

K5H—a performance report on another Kennametal grade with ideas you can use to cut machining costs

Severely interrupted cutting of SAE 4340 forgings with K5H grade, triangular insert in Kennamatic tool.

K5H grade insert tools successfully face aircraft forgings heat treated to 220,000 psi tensile

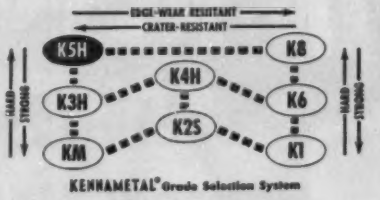
These tough, heat-treated SAE 4340 steel landing gear parts, heat treated to 220,000 psi tensile strength (Rockwell 47C), require severe jump cutting operations.

Using various grades of standard brazed tools, the Menasco Manufacturing Company rough and finish faced both sides at 87 RPM and .0035-inch feed. Even at this relatively low speed and feed, tool life was only two to four pieces per grind. Three cuts were necessary on each side of the forging. Approximately 6.35 minutes were required to change these tools—15 minutes to regrind them.

With K5H inserts in Kennamatic* tools, these forgings are now faced at 150 percent greater speed and twice the previous feed. Only two cuts are required on each face. Rotating the insert to a new cutting edge takes 45 seconds. Since three cutting edges are available on each end of the triangular insert, both sides of 54 pieces are faced before regrinding is necessary. Both ends of the insert are reground in 10 minutes.

K5H is the hardest of the Kennametal* grades. It is highly resistant to cratering, abrasion, galling and pick-up and is available in solid tools and inserts for precision boring and fine finishing of steel at high speeds. K5H is very strong for such a hard material.

The Kennametal Grade Selection Guide (below) offers you a simplified method for pin-pointing the exact grade of carbide that will assure top tool performance on every machining job. It shows that K5H is the hardest, most crater-resistant of the Kennametal grades. If this grade is being used and cratering is no problem, a change to K8 will provide greater edge-wear resistance. Or, if additional strength is desirable, K3H will improve tool life.



Tool breakage, chipping, excessive edge or top surface wear, heat checks and other causes of poor tool performance indicate a need for tool wear analysis. A Kennametal Tool Engineer is ready to help you with these problems . . . to help you select the best grade and tool for any job. In addition to his own broad experience, he has available to him the backgrounds of 150 other Kennametal Tool Engineers. He's as near as your telephone. Call him, or write to KENNAMETAL INCORPORATED, Latrobe, Pennsylvania.

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WEAR AND HEAT-RESISTANT PARTS

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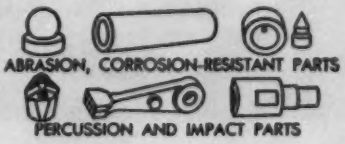
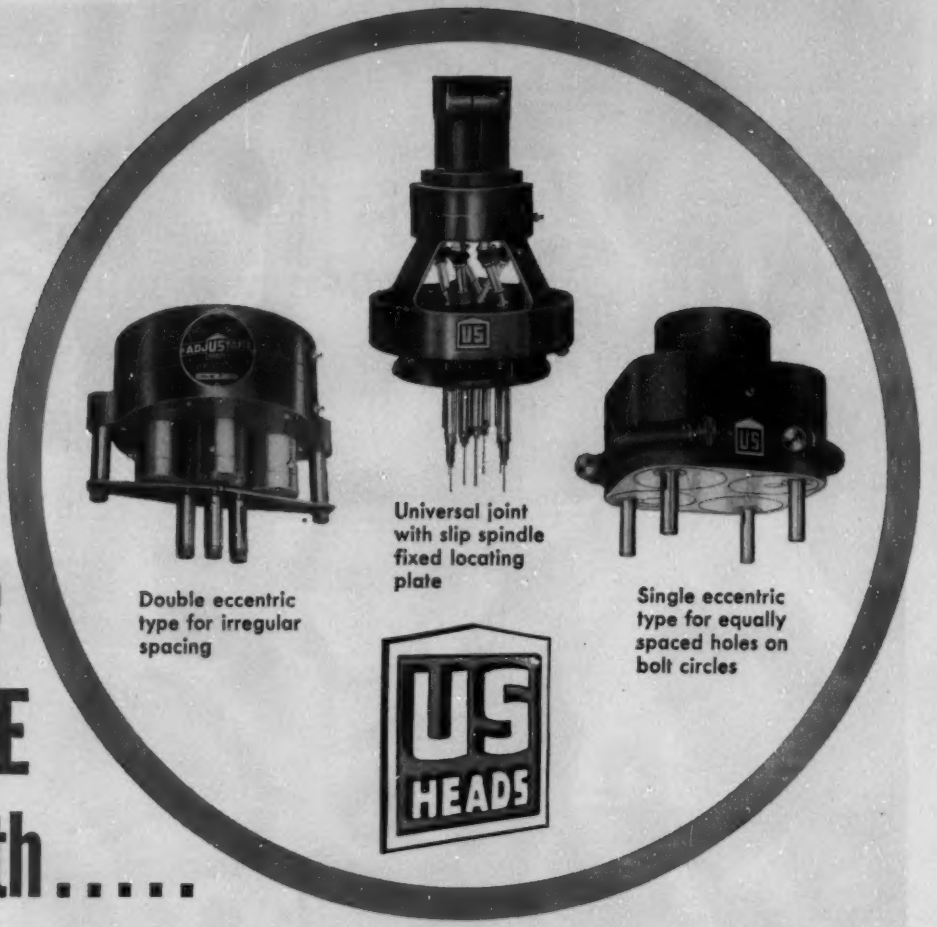

ABRASION, CORROSION-RESISTANT PARTS
PERCUSSION AND IMPACT PARTS


Double eccentric type for irregular spacing
Universal joint with slip spindle fixed locating plate
Single eccentric type for equally spaced holes on bolt circles
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Machine tool men "in the know" have long acclaimed the "US" Adjustable Multiple Spindle Drill Heads with their quick-change universal joint assemblies. They are built for continuous use, with full anti-friction bearing construction for high capacity thrust loads. The universal joint adjustable multiple spindle type is suitable for any sensitive drilling machine. Joints are self-lubricating.

The single eccentric type is used for equally spaced holes on bolt circles.

The new double eccentric AdjUStafix, two to eight spindles, permits spindles to be located in non-symmetrical patterns. It eliminates expensive change in set-up.

Write for details on any type of universal joint adjustable head. Ask also about our totally enclosed gear-driven adjustable, fixed center, or individual lead screw tapping heads.

UNITED STATES DRILL HEAD CO., 616-618 Burns St., Cincinnati 4, Ohio

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YES, father knows best — or at least he knows his fastenings and what makes them hold fast, *and last.* Nothing else but good, *solid* Brass that you can always bank on . . . *Bristol* Brass, for example.

And more and more manufacturers of screws, rivets, pins and other cold formed products are learning of the savings to be had from the remarkable versatility of wire developed by Bristol engineers. Nothing else permits the making of more types of products and heads (round, flat, etc.) from the same stock. Once they try it, manufacturers reorder from Bristol to take advantage of the inventory simplification offered by Bristol Brass wire.

Brass wire has always been a favorite of manufacturers because it is so easy on tools and machines. And many of them specify *Bristol* Brass wire because they find it consistently uniform in gauge, temper and grain-size — and because Bristol's delivery promises *are kept.* See for yourself. Send us a trial specification *now.*

The BRISTOL BRASS CORPORATION has been making Brass strip, rod and wire here in Bristol, Connecticut since 1850, and has offices and warehouses in Albany, Boston, Buffalo, Chicago, Cleveland, Detroit, Milwaukee, New York, Philadelphia, Providence, Rochester, Syracuse. The Bristol Brass Corporation of California, 1217 East 6th St., Los Angeles 21. The Bristol Brass Corporation of Ohio, 1607 Broadway, Dayton.

"Bristol-Fashion" means Brass at its Best

Want Exclusives? Latest Developments? Better Protection?

LOOK FOR

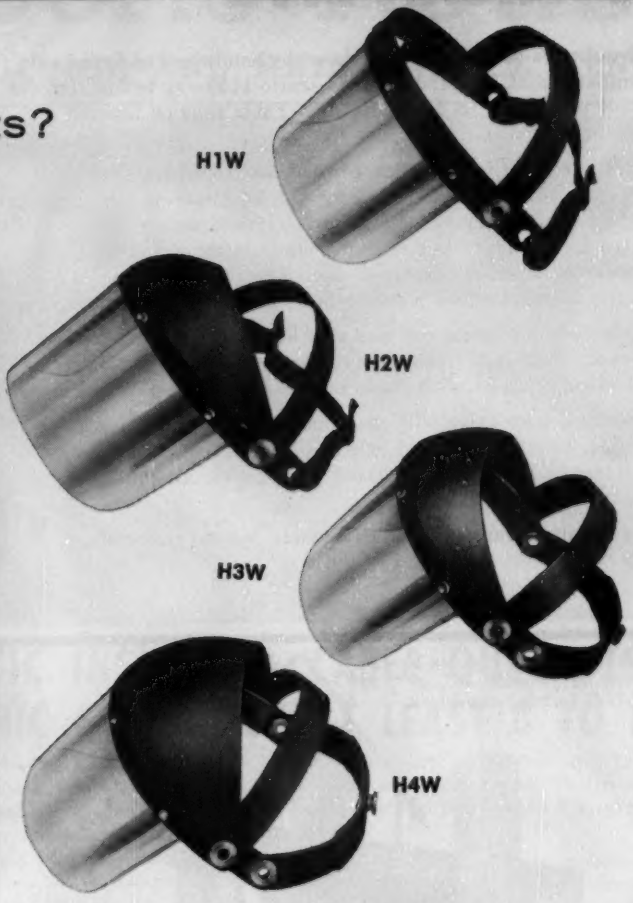
ALL 3

IN

ALL 4

NEW

AO "H" SERIES FACE SHIELDS



AO research and engineering step forward again with several additional safety advances in facial protection for your workers! This NEW Face Shield Series features a deep spark deflector which blocks foreign particles from entering at top of face shield. Window sets out about ¾" to allow adequate clearance over nose and prescription glasses. An AO exclusive is the slot and snap fastener device which, by allowing for expansion due to heat, eliminates wear at the holes, and cracking, warping and distortion of the windows. (U. S. Patent No. 2,610,323). Another new development is the lightweight grommet-friction washer combination for permanent adjustment. Your nearest AO Safety Products Representative can supply you with these quality shields.

QUICK FACTS

Specially treated (anti-perspiration) soft, genuine leather sweatbands.

Windows easily interchangeable (simplifies handling, stocking, assembling).

Windows available in clear or green acetate, 24 mesh screen, and fibre.

For complete details on all 4 "H" Series Face Shields (H1, H2, H3, H4) write for new brochure S-2141 . . . do it to-day.

RECOMMENDED USES: For metal sawing, chemical operations, buffing, sanding, light grinding, light bulb and glass bottle manufacturing, radio and television tube exposures, bottling operations and similar eye and facial hazards encountered in industry.

American Optical
SAFETY PRODUCTS DIVISION

AO SAFETY ZONE

Keep your workers in the Safety Zone with American Optical Safety Equipment.

SOUTHBRIDGE, MASSACHUSETTS • BRANCHES IN PRINCIPAL CITIES

See why Tool Engineers call these heavy producers,

"MOST MODERN MACHINES OF THEIR TYPE"

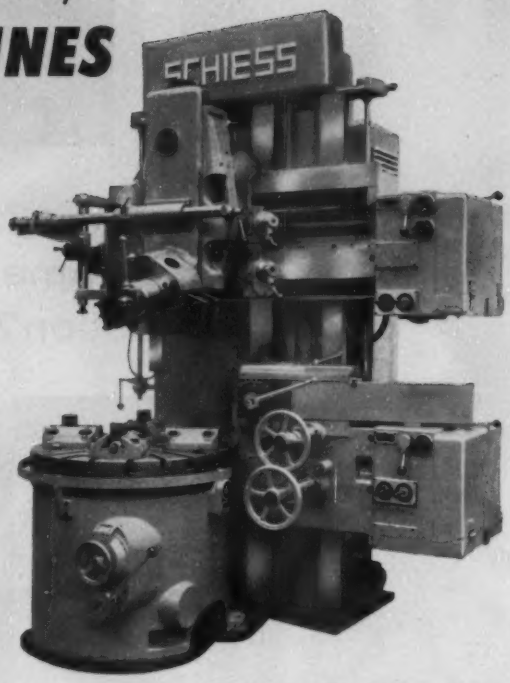
Hydraulic pre-selection of speeds set by handwheel and read on illuminated dial. 16 spindle speeds—ratio 1:50—up to 310 rpm for carbide machining on Model KE 100. Table runs on tapered roller bearings.

Fingertip control for direction of feed and rapid traverse with spring-loaded mono-levers for normal direction plus angular compound feeds. Mono-levers move in same direction as desired feed or traverse movement, simplify correct setting by operator. Specially designed electro-magnetic disc clutches disengage feed instantly with no over-riding or coasting.

Counterbalanced cross rail and side head. Single lever unlocks, raises or lowers, and locks cross rail simultaneously by electro-mechanical controls. *No bolts or nuts to loosen or tighten by hand.*

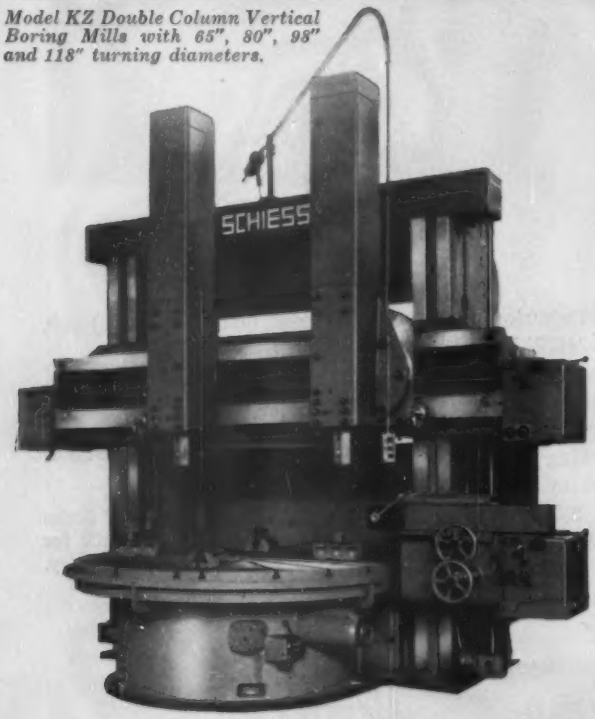
All-vertical gear drive with main motor mounted on back of machine, directly connected to gear box. Changes in direction of drive transmitted to table without bevel gears, eliminating vibration and backlash.

Copying attachment with electric tracer for use either on cross rail or side head.



Model KE Single Column Vertical Turret Lathes with 40", 50" and 65" turning diameters for high-speed carbide machining.

Model KZ Double Column Vertical Boring Mills with 65", 80", 98" and 118" turning diameters.



All operating features of KE Series Vertical Turret Lathes are combined in

SCHIESS KZ DOUBLE COLUMN VERTICAL BORING MILLS, PLUS—

Heads equipped with steel octagon rams can be swiveled—have automatic feed in vertical, horizontal and angular direction and are independent of one another as to amounts and direction of feed. Table operated by three-button pendant control. Standard model KZ Double Column Vertical Boring Mills are available with 65", 80", 98" and 118" turning diameters.

Get to know these products of Europe's largest builder of heavy machine tools. Parts and service are as close as Pittsburgh. An American Schiess engineer will be happy to help you size up these heavy producers for your heavy production needs. Write for catalogs and complete specifications on these and all Schiess KE machines.

Engineering Division

AMERICAN SCHIESS CORPORATION

38th Street and AVRR, Pittsburgh, Pennsylvania

Sole Distributor

KURT ORBAN COMPANY, INC.

34 Exchange Place, Jersey City, N. J.

DOW CORNING CORPORATION

Silicone News

FOR PRODUCTION AND MAINTENANCE MEN

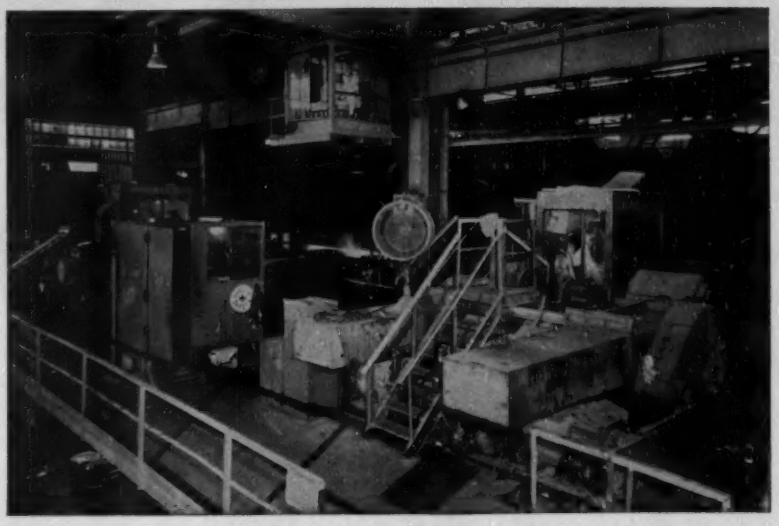
Silicone Compound Protects Electrical Connections; Stops Corrosion; Prevents Seizing

A steadily growing number of favorable reports indicate Dow Corning 5 Compound is a practical solution to many of the small problems that plague electrical maintenance men. Unaffected by most chemicals, salt spray, moisture and weathering, this silicone compound has good electrical insulating properties and will not harden or melt at temperatures from —100 to +300 F.

In a large percentage of the applications reported, Dow Corning 5 is used to protect electrical connections such as switch contacts, wire splices and lamp bulb bases against corrosion. When smeared on fuse clips, for example, a thin film of this paste-like compound keeps cartridge type fuses from corroding in place. A chemical manufacturer reports that toggle switches coated with Dow Corning 5 are still operable after 3 months' exposure to corrosive chemical fumes. Previously, a weekly maintenance check was necessary to replace seized switches.

Other applications in which Dow Corning 5 successfully reduces maintenance costs include its use to seal and insulate electric

(*Continued pg. 2*)



SILASTIC INSULATED CABLE OUTLASTS ORGANIC COVERINGS AT LEAST 8 TO 1

The No. 1 reheating furnace in Kaiser's huge Fontana, California rolling mill is fed by a slab pusher—an electrically driven ram which shoves steel slabs off a conveyor into the furnace. Under-ground conduit protects the control cables that carry 250 volt dc current to the pusher. That is, it did until a second furnace was built over the conduit run.

When heat from the second furnace caused rapid failure of the original lead covered cable insulation, the Kaiser Steel Electrical Maintenance Department switched to a high temperature organic rubber. But the line was so hot that a hemp rope used to pull new cable through the conduit scorched within an hour. Asbestos insulated cable was also tried, but proved impractical because of moisture condensation.

Each cable failure cost 1 to 2 hours of lost production while temporary surface lines were hooked up. An additional 6 to 8 hours was required for electricians to splice or replace the burn-out.

In 1951 cable covered with Silastic*, the Dow Corning silicone rubber, was installed. There have been no failures and the original cable is still in service. That kind of performance led to the installation of more than 10,000 feet of Silastic insulated cable in other hot spots throughout the mill.

That's typical of the way engineers, maintenance men and top management swing

*T.M. REG. U.S. PAT. OFF.

(*Continued pg. 2*)

Cost Study Proves Silicone Paint Most Economical For High Temperature, Corrosive Atmosphere Service

A recent article in *Oil and Gas Journal* cites detailed figures that prove silicone based paints are the most economical for applications involving high temperatures and/or corrosive atmospheres. Based on a study of maintenance costs at a large Southern gas transmission plant, the figures show that while the initial cost of silicone paints is about twice that of conventional protective coatings, silicone paints provide at least 3 times the service life.

After construction, new mufflers and stacks were cleaned, and then painted with 2 coats of silicone based aluminum paint. The cost per 100 square feet is shown in the box.

From past experience the company knew that the use of silicone paint would be economically sound if it remained effective only twice as long as the organic coatings used on similar installations. Although surface temperatures in this study ranged from 400 to 600 F, no additional maintenance was required for three years or 3 times as long.

Labor at $1.85 hour		
Sandblasting	$3.29	
Scaffolding	$2.46	
Painting	$3.29	$9.04
Materials		
Sand at $4.50 yd.	$2.00	
Paint, silicone aluminum at $17.50 gallon	$7.78	$9.78
Total Labor and Materials		$18.82

Costwise, that's about $.063 per square foot for a full year's protection. Compare that figure with your own annual costs for maintaining metal surfaces exposed to high temperatures and corrosive conditions. It's easy to understand why cost conscious maintenance men are changing to silicone based protective coatings.

No. 12

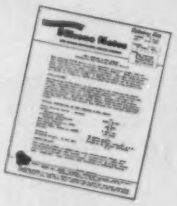
FOR DATA RELATING TO THESE ARTICLES, CIRCLE REFERENCE NUMBER IN COUPON ON NEXT PAGE

MORE

DOW CORNING CORPORATION

Silicone News

DOW CORNING PUBLICATIONS ON NEW DEVELOPMENTS AND TECHNICAL DATA . . .



For dependable service under the severe operating conditions frequently encountered in power distribution, welding and electronic applications, Class H transformers may be obtained from the companies included in a list of nearly 100 manufacturers of Class H transformers. *No. 16*

Δ

Dow Corning 7 Emulsion, a water dispersible silicone release agent, is effectively used in the rubber, plastics, plywood and metal fabricating industries. For data on its properties, uses, and application methods, check reference *No. 17.*

Δ

"Industrial and Laboratory Evaluation of a Silicone Protective Cream", is a clinical report on the effectiveness of a skin cream made with Dow Corning silicones against dermatitis resulting from contact with industrial irritants and sensitizers. Reprints are now available. *No. 18*

Δ

"What's a Silicone?" is the title of a 32 page booklet which answers that often asked question in semi-technical terms. Indexed and illustrated, this booklet has earned an international reputation as the most interesting and informative description of silicones ever published. *No. 19*

Δ

Dow Corning Antifoam A, recognized as a most effective defoamer for a wide variety of aqueous and nonaqueous systems, is now available from laboratory supply houses in convenient spray bomb dispensers. Combined with a volatile Freon propellent, Antifoam A Spray quickly and economically controls foams in many batch processes. *No. 20*

Δ

Dow Corning 55 Pneumatic Grease provides dynamic lubrication between rubber and parts in pneumatic systems; designed to meet Specification MIL-L-4343A. Serviceable over a wide temperature range, and oxidation resistant, it shows superior lubricity over other silicone greases with certain metal combinations. *No. 21*

Δ

"Silicones in Plant Auxiliaries" is the title of a significant article that appeared in the November 15th issue of ELECTRICAL WORLD. It tells how Consolidated Edison is using silicone (Class H) insulation to increase the life and reliability of motors and transformers. Solid proof of the performance of silicone insulation are orders placed since 1945 for over 106,700 hp in Class H motors rated from 200 to 2500 hp for station auxiliary power drives. *No. 22*

SILICONE INSULATION SAVES $500,000; INCREASES PUMPING CAPACITY 27%

Much of the sea water pumped into The Dow Chemical Company's famous "magnesium from the sea" plant in Freeport, Texas, is handled by six 71,000 gpm centrifugal pumps. Each pump is direct-driven by a 300 hp, 277 rpm motor. The entire line of motors is mounted on a massive underwater concrete foundation.

Recently Dow's plant expansion program reached the point where a pumping capacity of 90,000 gpm per unit was required. That capacity could be reached by 450 hp motors operating at a higher speed. But conventional motors rated at 450 hp would be almost half again as large, and much heavier than the existing units.

Larger motors would require extensive changes in mounts, brackets and other fittings, as well as reinforcement of the underwater foundations. Estimates of the cost of reinforcing the foundations alone ran as high as a half-million dollars. And that's not counting the cost of the new motors or the fact that the work would have to be done all at once, shutting off the intake canal and all but halting plant production.

Dow engineers solved the whole problem at a minimum cost and delay by having the motors rewound, one at a time, with

silicone (Class H) insulation to develop 450 hp at 327 rpm. Capacity of each pump was increased from 71,000 to 90,000 gpm without any further modification of the installation.

An extra advantage of Class H insulation was demonstrated when one of the motors was removed to correct a shaft rub at the upper seal. This same motor had also developed a small leak in its upper housing. When the motor was disassembled, the bottom ends of the coils were found to be immersed in 25 gallons of rain water. And still the silicone insulated coils remained in good operating condition. *No. 15*

SILICONE COMPOUND PROTECTS *(Continued)* cable, solenoids, insulators and a variety of electronic equipment including condensers and antennae. As a lubricant for rubber gaskets, plastic bearings and leather diaphragms, Dow Corning 5 also protects and preserves, thus increasing the service life of such units.

Considering the wide range of usefulness already established for Dow Corning 5, it appears profitable to furnish each maintenance electrician with one of the 2 or 8 ounce tubes available from most electrical distributors. Larger quantities, 10 lb. cans or 45 lb. pails, may also be obtained from most distributors or through the nearest Dow Corning branch office. *No. 13*

SILASTIC OUTLASTS 8 TO 1 *(Continued)* to Silastic cable, once they've put it to the test. It's the only rubbery insulating material that retains both resilience and good dielectric properties at temperatures from —100 to over 500 F. That's why it pays to try Silastic first wherever continuous service is required at temperatures far above and below the limits of any other class of rubbery materials. *No. 14*

Dow Corning Corporation, Dept. ERI-22, Midland, Michigan

Please send me: 12 13 14 15 16 17 18 19 20 21 22

NAME _____

TITLE _____

COMPANY _____

STREET _____

CITY _____ ZONE ____ STATE _____

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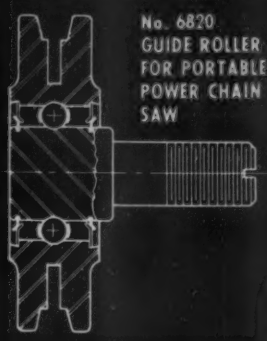
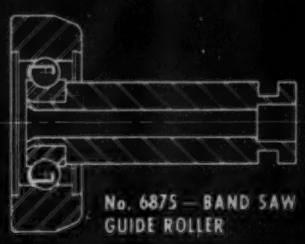
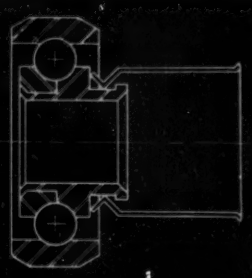


No. 6820 GUIDE ROLLER FOR PORTABLE POWER CHAIN SAW

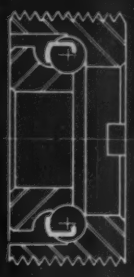


No. 6875 — BAND SAW GUIDE ROLLER

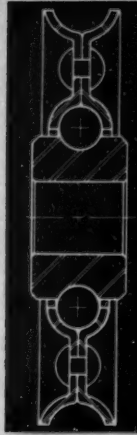


No. 6661 BEARING FOR IMPRESSION ROLLER SHAFT OF DUPLICATING MACHINE

Specialists in Specials



No. 6959 THREADED O. D. CADMIUM PLATED BEARING FOR RADIO TUNING DEVICE



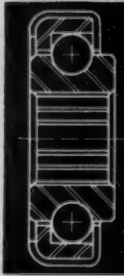
No. 6823 THEATER CURTAIN CONTROL ROPE SHEAVE

"Specials" are ball bearings which have been custom designed to be "exactly right" for a particular application. Thus, the field for specials ranges from modification of existing standard bearings to complete new bearings of unusual shapes and dimensions.

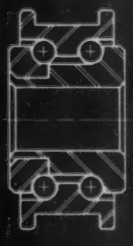
As "specialists in specials", experienced NICE engineers take advantage of every design opportunity to reduce costs and to improve product performance and appearance.

NICE invites inquiries on YOUR special requirements.

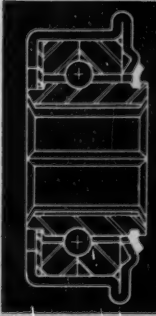
No. 7025 NYLON TIRED ZINC PLATED ROLLER FOR DISHWASHER



No. 6788 GRAVITY ROLLER CONVEYOR BEARING



No. 6970 GUIDE ROLLER FOR SHEET METAL TRIMMER

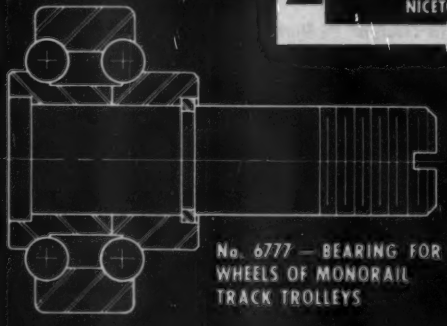


No. 6768 BEARING FOR CONVEYOR ROLLERS

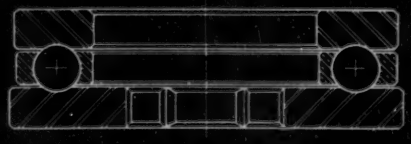
NICE

NICE BALL BEARING CO.

NICETOWN • PHILADELPHIA • PENNSYLVANIA

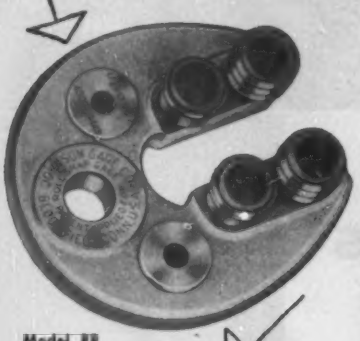


No. 6777 — BEARING FOR WHEELS OF MONORAIL TRACK TROLLEYS



No. 6579—THRUST BEARING FOR IMPACT WRENCH

JOHNSON'S new ROLL-Snap THREAD Gage



Model RR

for the utmost in

- ECONOMY
- FLEXIBILITY
- SPEED
- SIMPLICITY

Here is the finest designed ROLL-Snap Gage on today's market. Its huskier, simplified construction actually *lowers* its production cost which means lower prices to you.

Incorporates such exclusive features as precision ground working surfaces on frame . . . all frames, rolls and studs interchangeable . . . Go rolls have restricted end play to detect "drunken" threads . . . Not Go rolls, cone and vee type, correct for Pitch Diameter check . . . lapped steel washers to assure permanent alignment and rigidity of studs. Roll guards optional.

Where more exacting control and information is required, Johnson RING-Snap thread gages or ROLL-Snap and RING-Snap Comparators, Analyzers, and Standard Accessories are recommended.

NEW illustrated literature explaining how to get maximum thread control at lowest costs is yours for the asking.

(Specify Form C-RR-54)

Johnson Gage

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BLOOMFIELD, CONNECTICUT

Now CONVERT YOUR STEEL HAMMER TO A Soft Faced HAMMER EASILY AND QUICKLY!

PATENT NOS. 2515431 AND 2499802
OTHER PATS. PEND

Strong steel cup with a soft metal or plastic insert which can be quickly fitted to your present hammer and held firmly in place by taut steel coil-spring as shown.

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440 SHREWSBURY STREET — WORCESTER, MASSACHUSETTS
MAKERS OF WORLD-FAMOUS HAND TOOLS FOR OVER 50 YEARS

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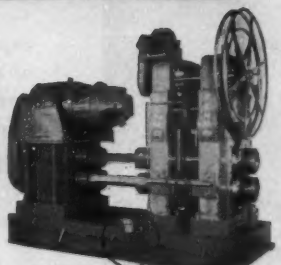
THERE'S NO SUBSTITUTE FOR KNOW HOW

Your **RUTHMAN GUSHER COOLANT PUMPS** give you



Illustrated is a Fenn No. 121 Two High Roller Bearing Rolling Mill equipped with a Model 5-PJ Long Gusher Coolant Pump.

1 ***Experience in Design*** . . . Ruthman Gusher Coolant Pumps were first in their field and have maintained their leadership over the years. Ruthman engineers are constantly at work to bring you an even better Gusher Pump.

2 ***Precision Built.*** Only tested materials and the best workmanship go into your Gusher Coolant Pumps. You can be sure of a long trouble-free life.

3 ***Efficient Operation*** is inherent in Gusher Pumps. You get split-second coolant flow and they require no priming or packing.

Always Specify Ruthman Gusher Coolant Pumps.

THE RUTHMAN MACHINERY CO.
1818 Reading Road Cincinnati, Ohio

STEP-UP Your Light Precision Machining with LIGHT TEN LATHES

Here is a whole series of small lathes designed and built to do your light precision machining. All have the same sturdy construction, the same convenience and ease of operation. There is a choice of 11 models for production, toolroom and maintenance work. Accessories, type of drive, length of bed, and equipment vary. Send for complete catalog and select the lathe which exactly suits your needs.

SPECIFICATIONS

Swing — 10" over bed

Collet Capacity — ⅝" max.

Spindle Bore — 27/32"

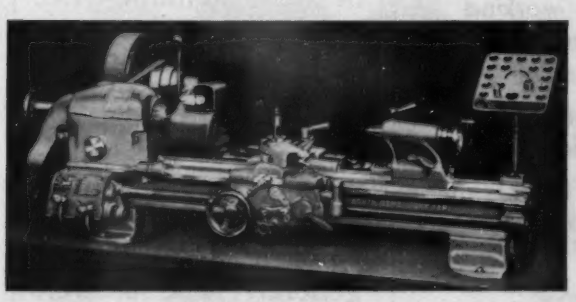
Distances Between Centers
Bench models — 16⅛", 22⅛", 28⅛", 34⅛". Toolroom bench models — 16⅛", 22⅛", 28⅛". Floor Models — 22⅛".

Spindle Speeds (approx.)
12-speed drives — 48 to 1435 r.p.m.
16-speed drives — 52 to 1365 r.p.m.

Power Longitudinal Feeds (R.H. or L.H.) Toolroom and Model A — 48, .0015" to .0853". Model B — 26, .0021" to .0155". Model C — 14, .0021" to .0156".

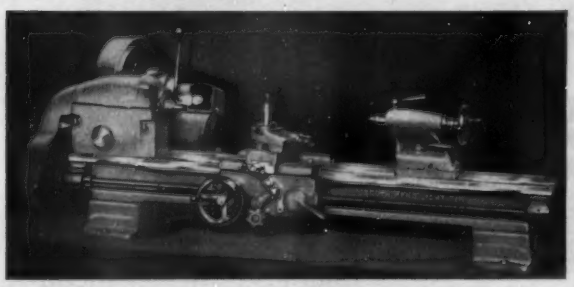
Power Cross Feeds (reversible) Toolroom and Model A — 48, .0004" to .0255". Model B — 23, .0009" to .0046". Cross-feed is hand operated on Model C.

Light Ten Floor Lathe—Model A. 12-speed Underneath Motor Drive—Quick Change Gears. Worm drive apron with power cross-feeds. Price as illustrated $821 f.o.b. factory.

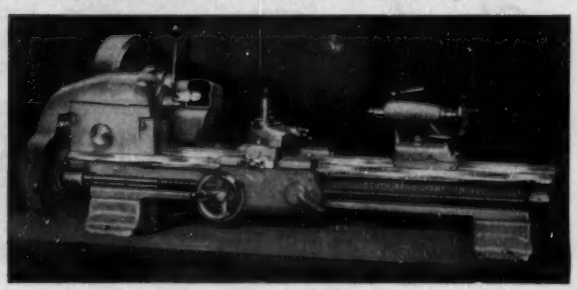


Light Ten Toolroom Precision Bench Lathe. Includes usual toolroom attachments. Price as illustrated $814.50 f.o.b. factory.

Light Ten Bench Lathe—Model A. Quick Change Gears. Worm drive apron with power cross-feeds. Price as illustrated $583.50 f.o.b. factory.



Light Ten Bench Lathe—Model B. Independent Change Gears. Worm drive apron with power cross-feeds. Price as illustrated $507.50 f.o.b. factory.



Light Ten Bench Lathe—Model C. Independent Change Gears. Plain apron with hand operated cross-feed. Price as illustrated $436.50 f.o.b. factory.

Compared with our costs
OUR PRICES ARE LOWER
than they were back in 1941

Prices are closely tied to costs. Costs are still rising. Buy now before increased costs necessitate higher prices.

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☐ 9" and 10" BENCH LATHES

☐ 10" to 16-24" FLOOR LATHES

☐ DRILL PRESSES

☐ ½" & 1" Collet TURRET LATHES

☐ TOOL GRINDERS

☐ 7" BENCH SHAPERS

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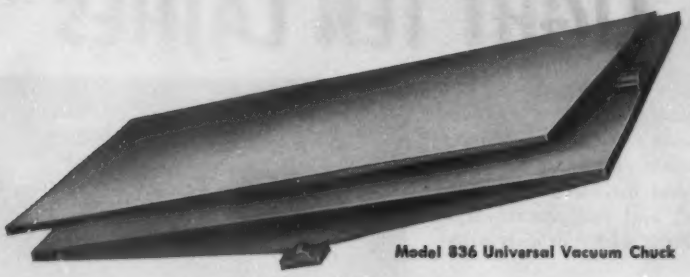

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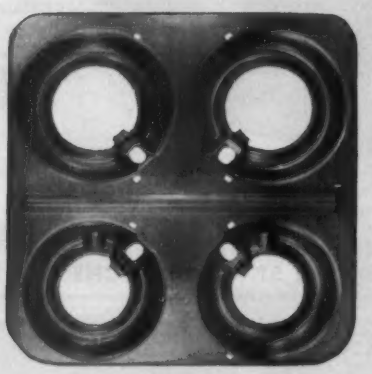

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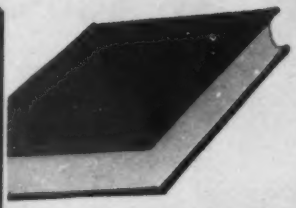

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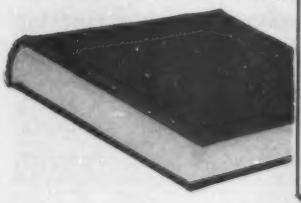

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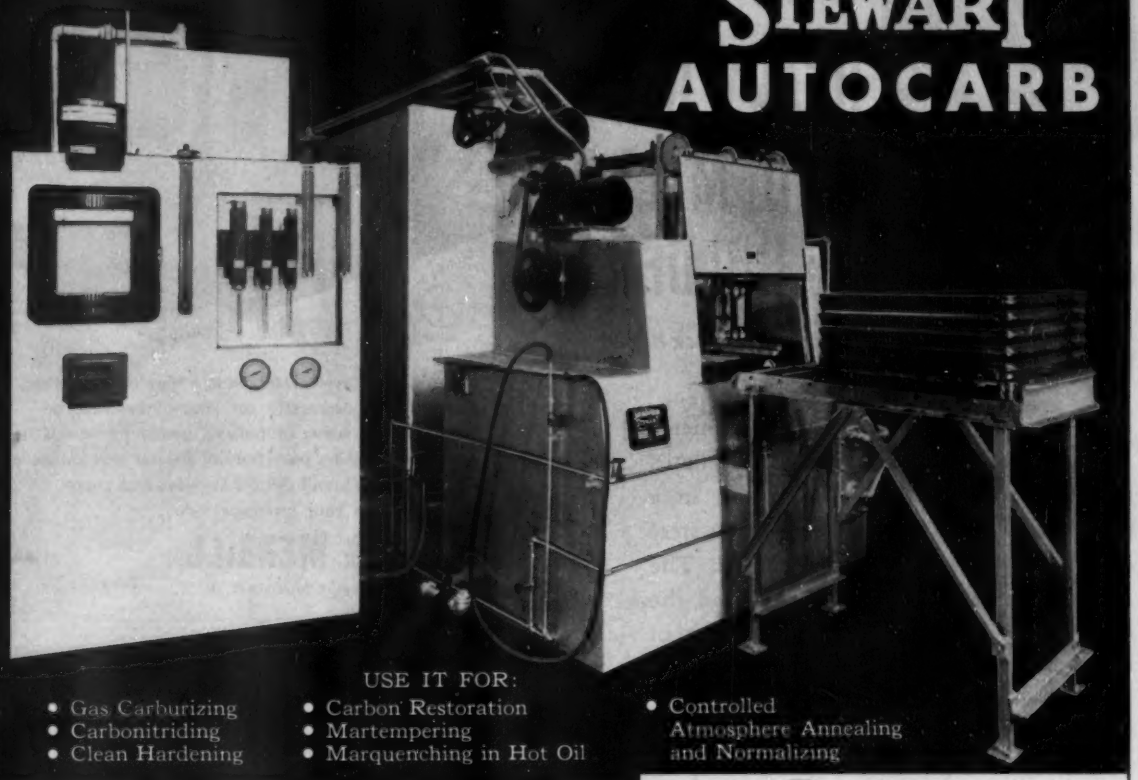

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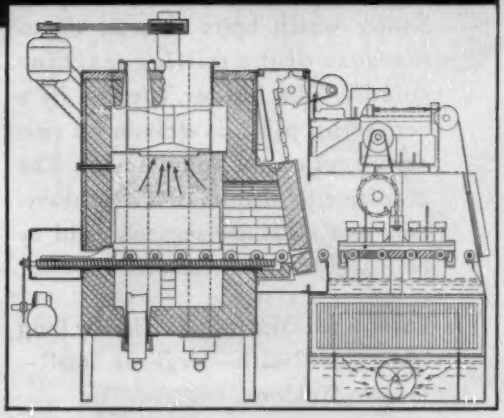

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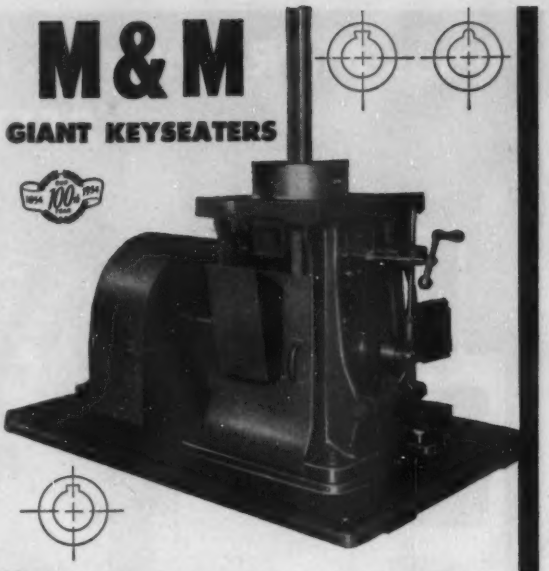

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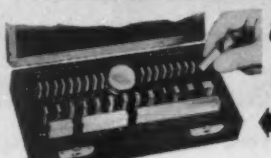

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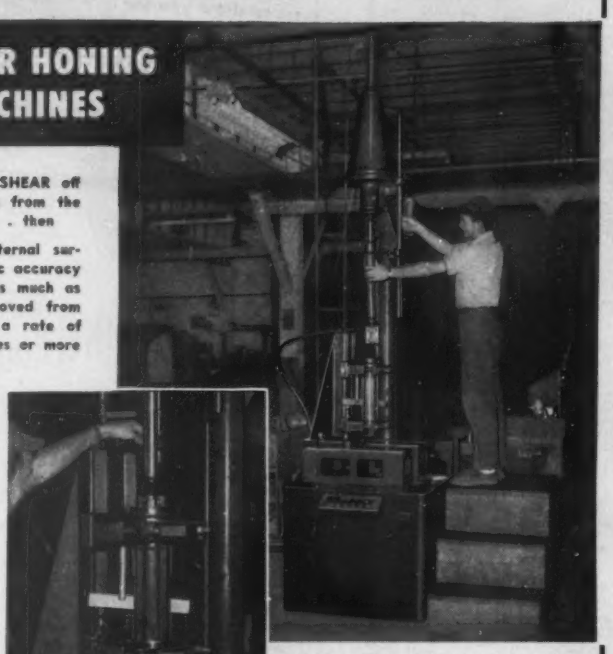

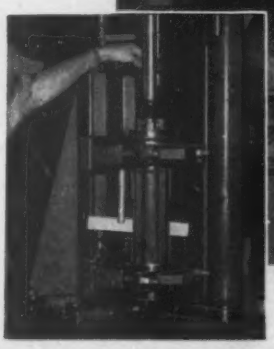

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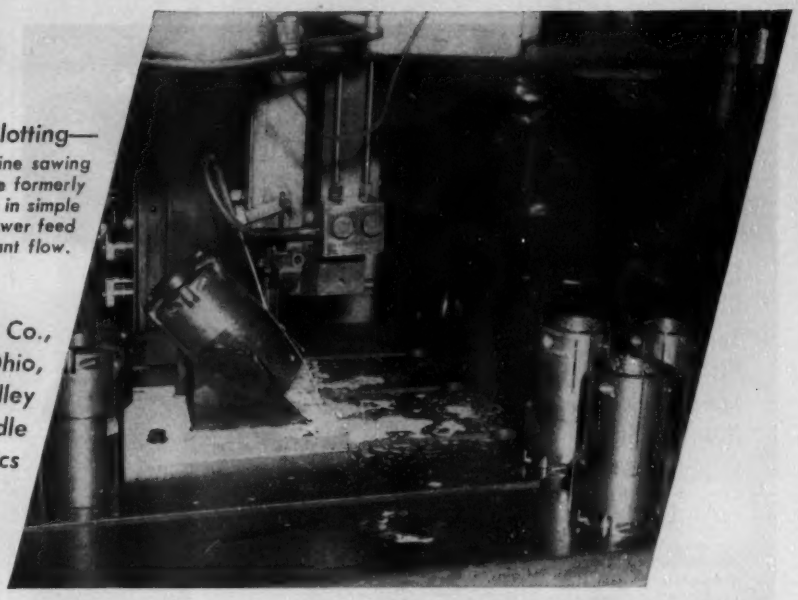

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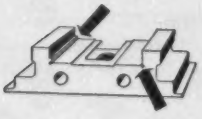

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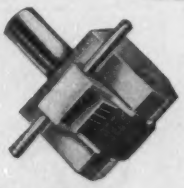

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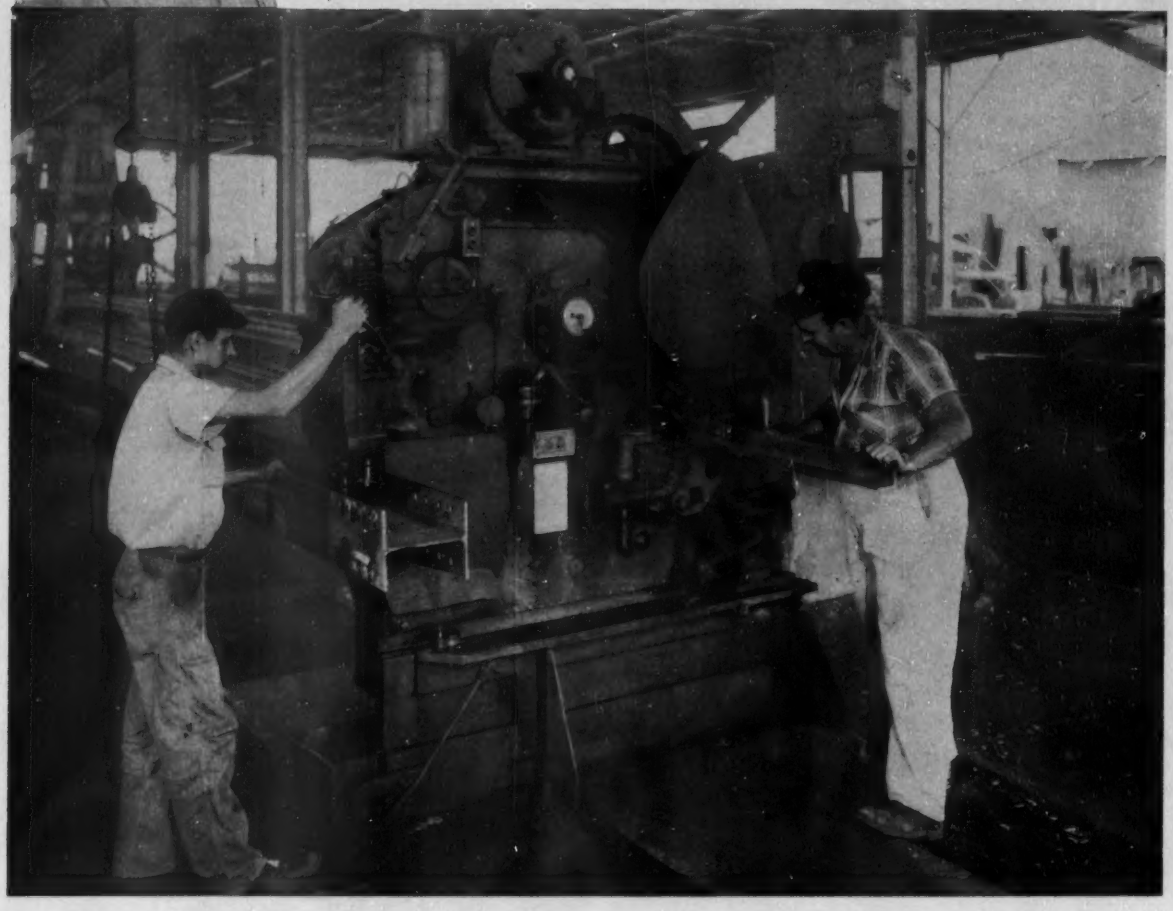

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What Mr. Delisle's men like about the U. I. W. is that you can do a whole shop-full of fabrication jobs on a work piece without traveling from machine to machine. You can do a wide variety of punching—such as the Bushnell man above is doing on the I-beam web and flange—while another man can be mitering angles or tees 90° or 45°, cutting round or square bars, cutting flats, slitting or notching at the same time. Small wonder so many users of "Buffalo" Universal Iron Workers call them the "most useful machines in the shop". Why not write for Bulletin 360-E and look into these durable, multi-purpose machines that will save space, dollars and hours in your shop?

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Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

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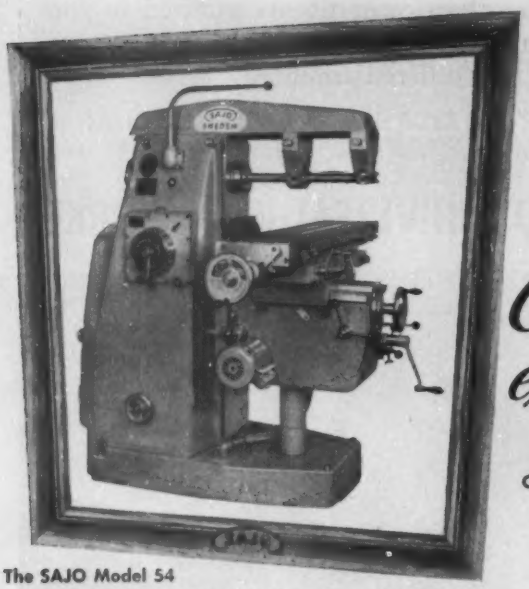

Classic example

OF SWEDISH CRAFTSMANSHIP

The SAJO Model 54
No. 2 ALL-GEARED Milling, Machine Plain or Universal

is an outstanding example of Swedish craftsmanship and fine quality materials, combined in a modern design.

Capable of continuous dependable service under the most severe conditions and guaranteeing maintenance of accuracy to tenths, the SAJO Model 54 Millers meet all requirements for:

POWER..... 7½ HP motor drive to spindle (5 HP optional).
1½ HP table feed and rapid traverse motor.

RANGE..... 16 spindle speeds 39-1500 RPM (optional 31-1200 RPM).
12 table feeds 11/16" to 25"/min. longitudinal and cross.
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Power rapid traverse 96"/min. longitudinal and cross. 48"/min. vertical.
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From the *American Machinist* Library of *Tips for Top Shop Men*

MICROSTRUCTURE, rather than composition, may frequently be the key to successful machining of a part. Two pieces that look alike and were made alike may be entirely different in their reaction to a tool.

Does jobs no drill can do! *up to 10 Times Faster than Boring!*

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Holes can't drift, spindle can't deflect—it's piloted 2 ways!

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Capacity:	1" to 2"	2" to 3"	3" to 4"	4" to 5"	5" to 6"

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204 147,5 mm.

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Milling and Boring Machine FAFT 147,5 mm. equipped whith swivelling arm, turning head and rotary table for turning, milling and dividing; working as normal milling and boring machine with eclipsable arm, and as vertical turning and boring machine with arm in working position.

Power available in the milling cutter: 40 HP.

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American Machinist published Bi-weekly with an add'l issue in mid-November at New York, N. Y., for Oct. 1, 1954.

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24", 36", 42" BULLARD Vertical Turret Lathe, New Era, Turret Head, Side Head, Motor Driven.

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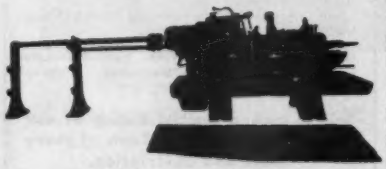
1A WARNER & SWASEY Turret Lathe, Heavy Duty, Power Chuck Wrench, Timken Bearing, M.D.

No. 2, No. 3, No. 5, No. 3A WARNER & SWASEY Geared Head Turret Lathes, Bar Feed, Motor Driven.

24"x10' AXELSON Geared Head, Heavy Duty Model "E" 28" Actual Swing, M.D. Taper Attachment. 1942.



No. 7 BARDONS & OLIVER Universal Turret Lathe. 2½" capacity. Preselector Head, Late Type.

No. 00G BROWN & SHARPE High Speed Automatic Screw Machine, Motor Driven, Late type.

No. 1 LaPOINTE Motor Driven Horizontal Broach, 5 tons cap., 38" stroke.

50 HP. CHICAGO PNEUMATIC Air Compresser. Type NSB, 253 CFM, Piston Displacement.

10"x10" RACINE #30-C Hydraulic Heavy Duty Shear Cut Power Hack Saw, 1946.

10'x10 ga., 10'x¼" WYSONG & MILES Power Squaring Shears, Motor Driven.

10'x10 ga. CINCINNATI Power Squaring Shear, many extra features; NEW 1948.

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600 ton NILES-BEMENT-POND Motor Driven Wheel Press, 86" between strain rods, 14' cap., 17" diam. ram.

#5, #7 JOHNSON O.B.I. Presses. 56, 79 tons cap. M.D. Flywheel & Geared Type.

MILLING MACHINES

#2-18 CINCINNATI Plain Auto. Milling Machine, M.D. Late Type.

#2 KEMPSMITH Horiz. Maxi-Mill, Motor in base, Vert. Head.

#08 CINCINNATI Vert. Mill, Plain & Rotary Table Type.

#3B KEARNEY & TRECKER Vertical Milling Machine, Motor in base.

No. 0-8 CINCINNATI Rise & Fall Horiz. Mill, Late Model.

No. 3B KEARNEY & TRECKER Horiz. Mill, Double Overarm, Motor in base.

No. 2M CINCINNATI Universal Horizontal Mill, Full Equipment, M.D.

96" x 86" x 28' NEWTON PLANER TYPE MILLING MACHINE. 2 Heads on Rail; 2 Side Heads; Pendant Control; Late Type.

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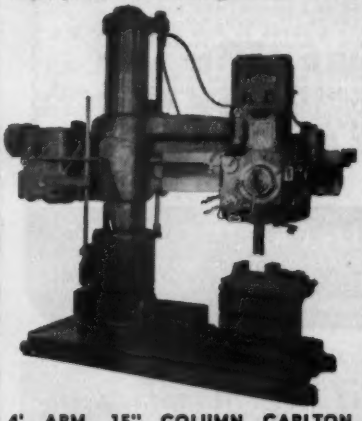
4'x15" Column CINCINNATI-BICKFORD "Super-Service" Radial Drill, Motor on arm, Box table.

No. 262 BARNES Motor Driven Sliding Head Drill Press. 2" cap. in steel. 1941.

No. 2 M.T. Six Spindle ALLEN Type KH Drill Press, Individual Motor Drive, Late Type. 1943.

No. M200 DEFIANCE Prod. Drill, 2" cap., #5 M.T., 26" swing, 1942.



4' ARM, 15" COLUMN CARLTON RADIAL DRILL. 48 SPINDLE SPEEDS 15-1500 RPM. MOTOR ON ARM. 1943.

½, 1½ BUFFALO FORGE Universal Ironworker, Notcher and Coper, M.D.

T-56 VERSON Power Press Brake, 8' overall, late type. 100 Tons Cap. 1942.

No. 20, WATERBURY FARREL Thread Roller, ⅜" cap., 1944.

GRINDERS

12"x36" LANDIS Universal Cylindrical Grinder, Excello Internal Spindle, M.D.

6"x18" LANDIS Type "C" M.D. Hyd. Cylindrical Grinder, Serial #29196.

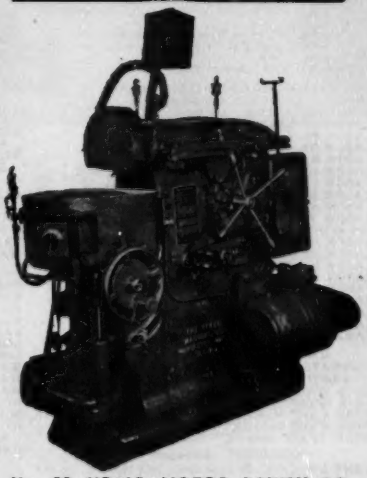
6"x18" NORTON Vertical Hydraulic Surface Grinder, complete with magnetic chucks, coolant systems, Late.

#TG615 JONES & LAMSON Thread Grinder, Late, M.D. and TG848.

No. 208 BESLEY Motor Driven Disc Grinder, 26" wheels, Late Type.

No. 13 BROWN & SHARPE Universal Tool & Cutter Grinder. Serial #5175. Complete tooling. 1943.

12"x36" MATTISON M.D. Hydraulic Surface Grinder, 15 HP Spindle Motor. Coolant System.



No. 22 HEALD MOTOR DRIVEN ROTARY SURFACE GRINDER. 12" Magnetic Chuck. Late Model.

20", 24", 28" GOULD & EBERHARDT V-Ram Shapers, M.D.

No. 194 BARNES Vertical Hone, 4" capacity, 12" stroke, Motor Driven.

30 K.W. LEPEL High Frequency Induction Heater.

No. 8LS FELLOWS M.D. Gear Lapping Machine. With Detachable Head, Universal Work Support.

15' x 10' x 36' BETTS PLANER, DOUBLE HOUSING, BOX TABLE. 2 Swivel Heads on Rail; 2 Swivel Side Heads; Pendant Control Variable Speed Main Drive Motor, 75 HP.

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ACME GRIDLEY RB 1½", 6-spindle; late type
ACME GRIDLEY RB, 1⅝", 6-spindle; late type
CONOMATIC 1⅞", 6-spindle; M.D., late type
CLEVELAND 3½" Model "A" Single spindle late
CLEVELAND 5", Model "A", single spindle; late
NEW BRITAIN GRIDLEY Model 665; 6-spindle chucker; latest type; new 1943.

BORING MILLS—Horizontal
NILES 8" bar; floor type; motor drive
HEALD 46B, 47A, #48A and #49 single end Borematic; M.D., late
HEALD No. 49 double end Borematic; M.D.

BORING MILLS—Vertical
BULLARD 8", 8-spindle & 16" 6-spindle Type "D" Mult-au-matic; late type
BULLARD 24" & 54" spiral drive, M.D., late type
NILES 53", 2 swivel heads, PRT; M.D.
NILES 100" 2 swivel heads, PRT; M.D.
SELLERS 144", 2 swivel heads on cross rail; PRT

BROACHES
CINCINNATI 1-30 Duplex Vertical cap. 1 ton 30" stroke; Hydraulic; late.
COLONIAL VGI-10-48 Vertical; Hydraulic; late
LAPOINTE 10-54" Vertical, Model SRV; new 1947
OILGEAR 3XA horizontal; cap. 20,000 lb; 50" stroke; hydraulic; late type
OILGEAR type XL-6 single ram; late type.

DRILLS
AMERICAN 4' arm 11" col. "Hole Wizard", late
AMERICAN 5' arm 11" col. "Hole Wizard", late
AMERICAN 5' arm 13" col. "Hole Wizard"; late
BARNES #281-¼, 4 spindle, M.D., late type
BARNES H-2 Hydram, 2" capacity; M.D., late type
NATCO B3B Hole Steel, 12 adj. spindles; late type
NATCO B4B arranged for 60 adj. spindles, late
NATCO E5 arranged for 12 adj. spindles; late

FELLOWS GEAR EQUIPMENT
FELLOWS No. 6 High Speed Gear Shaper; late
FELLOWS No. 48 High Speed Gear Shaper; internal cap. 72" diameter; late
FELLOWS No. 6IA & 6I5A High Speed Gear Shaper; late type
FELLOWS No. 6Z2 High Speed Gear Shaper; late
FELLOWS #74 and #75 High Speed Gear Shaper; late type
FELLOWS No. 13L8 Lapper; motor drive, late

GLEASON GEAR EQUIPMENT
GLEASON 3" Spiral Gear Generator; late
GLEASON No. 4 Tester; late type
GLEASON 11" Straight Bevel Gear Gen.; M.D.
GLEASON No. 7 Hyp. Cutter Sharp; latest type
GLEASON No. 12 Tool Sharpener; motor drive
GLEASON No. 13 Hyp. Cutter Sharpener; late
GLEASON 12" Spiral Bev. Cutter Sharpener; M.D.
GLEASON 12" Straight Bevel Generator; late
GLEASON No. 14 Spiral Bevel Hyp. Gear Grinder
GLEASON No. 15 Quenching Press; late type
GLEASON No. 17 Spiral Bevel, Zerol and Hypoid Gear Grinder, M.D., late
GLEASON 18" Straight Bevel Gear Gen.; M.D.
GLEASON No. 16 Gear Tester and Lapper; M.D.
GLEASON No. 20 Spur Gear Tester; latest type
GLEASON #22 Hypoid Formate Gear Finisher; late
GLEASON 24" Bevel Gear Planer; motor drive
GLEASON 26" Straight Bevel Gear Gen.; M.D.
GLEASON 27" Bevel Gear Planer; M.D.
GLEASON 29" Spiral Bevel Gear Gen.; M.D.
GLEASON No. 6 Revacycle 3" cone distance; late

GRINDERS, Cyl. Plain & Univ.
CINCINNATI 14"x72" Universal; M.D., late type
CINCINNATI 8"x18" Plain, "Fimatic"; late type
LANDIS 10"x18" type C Plain, Hydraulic, late
LANDIS 10"x36" type DC plain hydr. with infeed; late
NORTON 4"x12" Model CTU Plain, year 1953
NORTON 6"x18" Type "C" Plain; late type
NORTON 16"x72" type "C" Plain; late type

GRINDERS, Internal
BRYANT #5, #16-C-16 Hydraulic; late type
BRYANT #24-36" Hydraulic; late type
HEALD #70A Int. M.D., late type
HEALD #81 Plain chuck type; New 1947
HEALD #72A8 Plain & "Gagematic"; late type

GRINDERS, Surface
ABRASIVE #34, 6"x24" table; late type
HEALD #22 Rotary, 12" chuck; M.D., late

LATHES, Turret
GISHOLT #1L and #2L Saddle type; Timken; late
GISHOLT #3 Universal ram type; M.D., late
LIBBY 4-H, 12" hole, Heavy Duty, M.D., late type
MOREY #2, #3, #4 ram type; Timken; latest type
WARNER & SWASEY #1-A Universal; Hex., late
WARNER & SWASEY #2, #3 and #5 Univ. ram type

LATHES, Engine & Mfg.
HENDEY 24"x36" centers; M.D., late type
LeBLOND 36"x204" Heavy Duty; PRT-Timken; late
LeBLOND 42"x108" H.D., Timken; M.D., late type
LODGE & SHIPLEY 12"x30" C.H. Toolroom
LODGE & SHIPLEY 14"x30" centers; late type
MONARCH Model EE 10"x30" Toolroom; late
MONARCH 12"x30" centers; Model CKK; late type
NILES "Time Saver" 36"x108" centers; late type
NILES 30"x50" bed, single end boring, "Time Saver"
PRATT & WHITNEY 16"x30" centers; Timken
REED PRENTICE 14"x54" Model B, Timken, late
SUNDSTRAND 10"x80" centers; auto Type B; late

MILLING MACHINES, Plain
BROWN & SHARPE #2 M.D. late type
CINCINNATI 1-18 Production; Timken; late type
KEARNEY & TRECKER 2HL & 4H, M.D., late

MILLING MACHINES Thread
HALL Style "D" Planetary; late type
LEES BRADNER Model #LT 6"x36" #HT 12"x24" and #HT 12"x36" centers; late type
MOREY 12"x30" and 12"x160" centers; late type

MILLING MACHINES, Universal
CINCINNATI 2MH Univ., motor drive, late type
CINCINNATI #3 Dial Type, Timken, M.D., late
KEARNEY & TRECKER #3K; Timken; late type
VAN NORMAN #22L, #26 and #36 ram type; late

MILLING MACHINES, Vertical
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16"x36" Norton type C, hydraulic (2), 1943
16"/26"x72" Norton type C, hydraulic, 1945
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16"/48"x90" Landis gap type hydraulic, new 1941

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8"x22" No. 3 Abrasive, motor in base (2)
12"x48" Model 300 Hanchett vert. spdl. 1946
14"x30" Pratt & Whitney vertical surface grinder, 1942.
72" No. 72 Hanchett rotary surface, 1946

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No. 13 Brown & Sharpe universal tool, new 1942

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No. 5 Bryant semi-automatic chucking
No. 2 Cincinnati centerless (3), 1942-1943
No. 49 Van Norman radius, 1945

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14"x42" Hendey G.H., M.I.B., 1940
24"x14 ft. bed American G.H., Q.C.G., serial 44870
52"x30 ft. bed Niles Bement Pond G.H., like new

LATHES, MFG. & MISC. & TURRET
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No. H5 Libby International saddle type universal turret lathe, 1940
No. 5 Jones & Lamson Universal ram type turret lathes, (2) late models

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No. 2 Cincinnati Hi-Power plain horizontal
No. 4 Cincinnati Hi-power plain horizontal
No. 5 Cincinnati Hi-power plain horiz., vert. attach.
No. 2-18 Cincinnati production mill, late
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No. 4-36 and 4-48 Cincinnati Hydromatic production
No. 2B and 3K Milwaukee universal
No. 3B and 5K Milwaukee universal
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37"x21"x12 ft. Ingersoll fixed rail planer type mill
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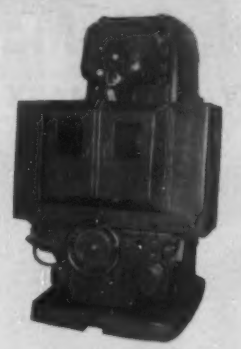

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100" Niles-B-Pond Vert. Bor. Mill.

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No. 2MA-6 Avey 24"—1 Spdl. Drill.
2 Spdl.—24" S.W.—No. 3 Avey
No. K60H Fox 16 Spdl. Multi Drill
No. 2-20" 2 Spdl. Leland-Gifford LMS Drill
No. LBM-20" 3 Spdl. Leland-Gifford Drill

Gear Machines
11" Gleason Gear Generator
No. 12HS Gould & Eberhardt
No. 36-BM G. & E.—3 spdl. Rougher
615-A Fellows Gear Shaper
612-A Fellows Gear Shaper

Grinders
6"x18" Norton Type C Plain (1943)
10"x18" Norton Type C Plain Hyd. Cam Gdr.
10"x36" Norton Type C Grinder
10"x36" Norton Type C Cam Grinder
16"-40" Gap x 120" Norton Pl.
18"x120" Norton Type C Pl.
20"x192" Norton Type A Pl.
B-24—25" Chuck Arter Surf. Gdr.
TG615 J & L Thread Gdr.
No. 214 Besly Double End Disc Gdr.

Internal Grinders
No. 5 Bryant Internal Grinder
No. 5B Bryant Internal Grdr.
No. 16-16 Bryant Int. Grinder
No. 16-28 Bryant Int. Grinder
No. 16-36 Bryant Int. Gdr.
No. 24 L-36 Bryant Hyd. Int. Gdr.
No. 16 A-28 Bryant Internal Grinder
No. 24-26 Bryant Int. Grinder
No. 24-36 Bryant Internal Grinder
No. 81 Heald Internal Centerless
72-A5 Heald Int. Gdr. (1942)

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Model 200-H5-Dbl. End. Micro. Horiz.
Model H-7 Micromatic Vert. Hone, etc.
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No. 306-H Barnes Vertical Hone

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12"x63" Fay Automatic
18"x6' Am. Geared Head Lathe
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No. 3 Warner & Swasey Turret Bar Feed
No. 4A Warner & Swasey Turret
No. 6 Warner & Swasey, cone head
2¼"x24" Jones & Lamson
18" Libby, M.D.
No. 3H-10 Libby International, 29" SW
No. 4A Warner & Swasey (1944)

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48"x36"x14' Gray, 2 Heads
48"x48"x12' Cincinnati, 2 Heads
60"x48"x27' American, 4 Heads

Milling Machines
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No. 3K Kearney & Trecker Vert.
No. 08 Cincinnati Vert. (1942)
10"x48" Hanson-Whitney Thrd. Mill
10"x60" Pratt & Whitney Thrd. Mill
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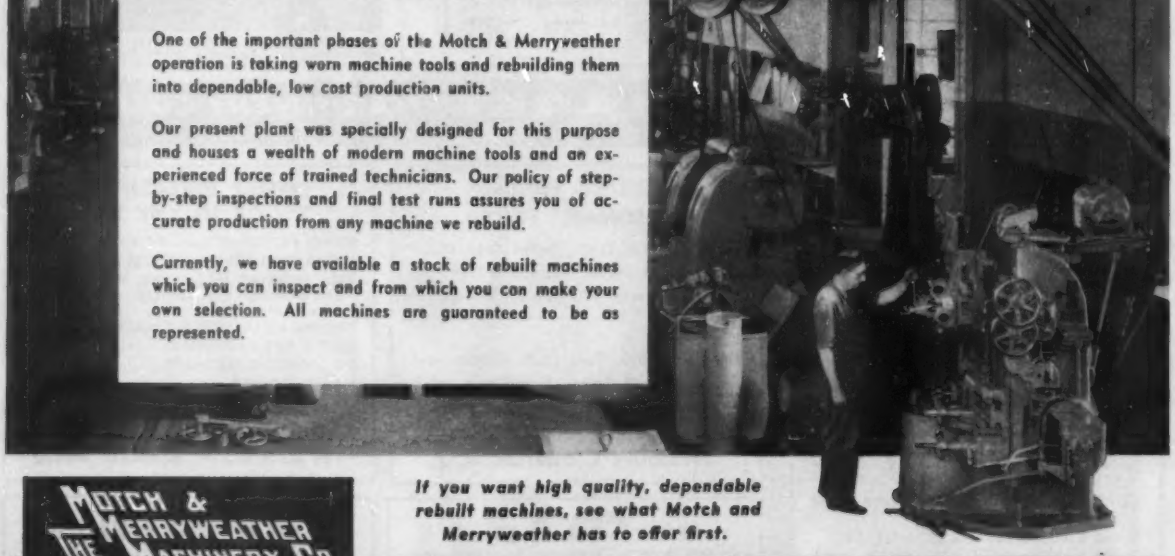

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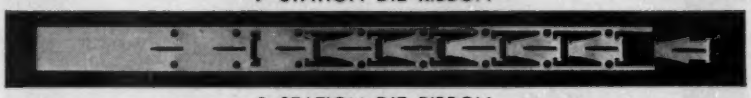

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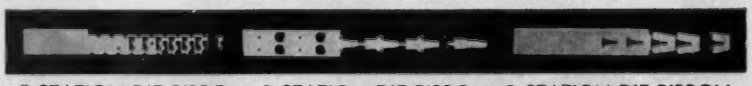

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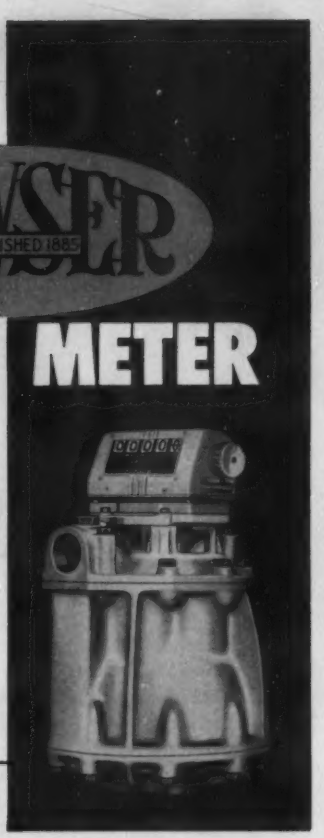

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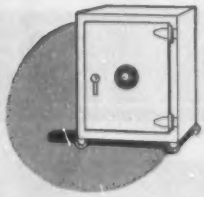

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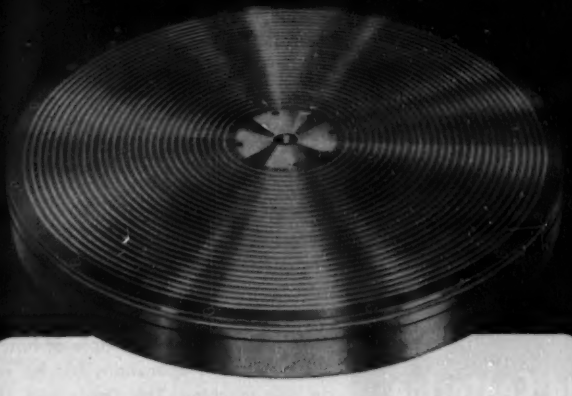

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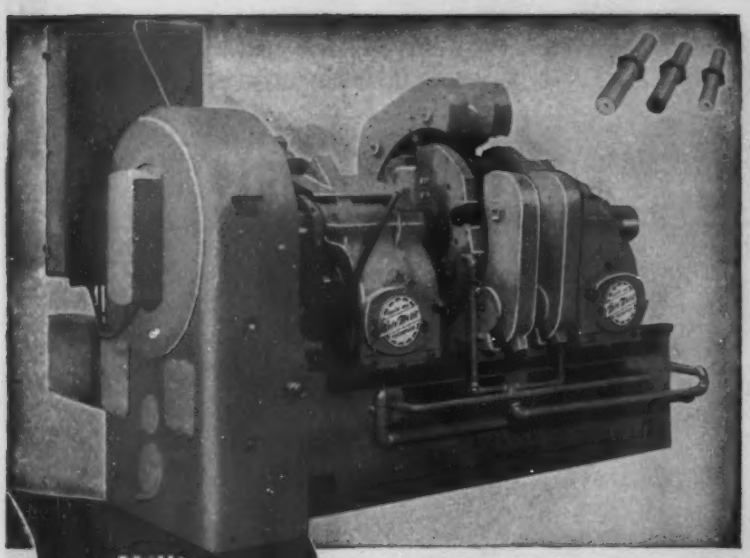

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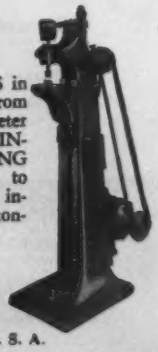

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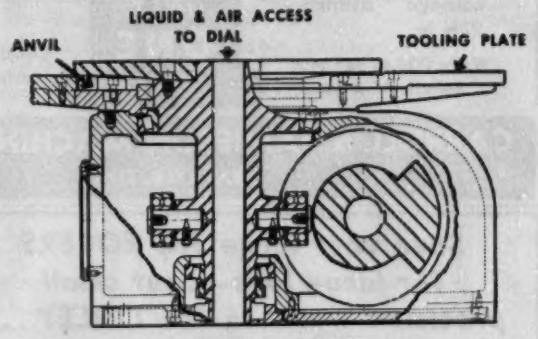

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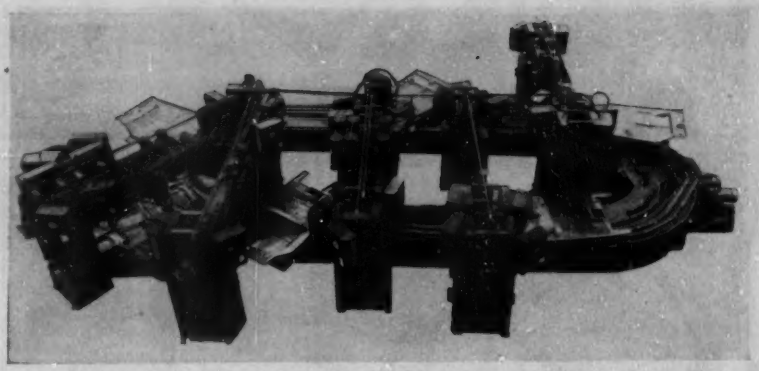


Early example of Federal Resistance Welding Automation is this Floor Pan Welder for a leading automobile builder. Placed into operation in 1938 it featured continuously moving fixtures and walking guns. Produced 250 units per hour.

Why All This Talk About Automation?

The automatic handling of work in process isn't a new idea. Leading manufacturers in almost every metal working field have been using "automated" machinery for years to increase the productivity of their work.

The talk about automation today, of course, is a result of the concentrated effort on the part of vast numbers of manufacturers, large and small, to stay competitive by trimming production costs whenever possible.

Federal, for almost a quarter century, has been working with such people in developing resistance welding machinery that would reduce costly, non-productive handling to a minimum.

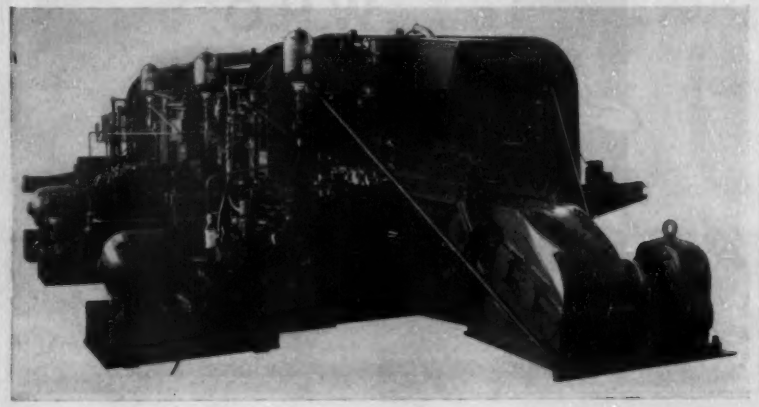
While automation may be new to many machine builders Federal design engineers have piled up 25 years experience in designing and building automatic handling and assembling equipment, dial, shuttle and transfer feeds for resistance welding. A big reason why you should take your welding problems to **"Federal — First in Resistance Welding."**

Federal® WELDERS

Warco® PRESSES

The Federal Machine and Welder Co., Warren, Ohio

Modern Example of Resistance Welding Automation is this Federal Special Three-Station Transfer Type Muffler Assembly and Welding Machine. It produces 600 complete assemblies per hour. Reduced labor forces required by several hundred per cent.



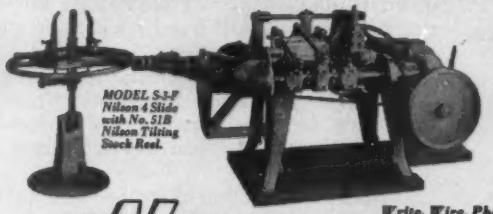
"Switching to NILSON 4 SLIDES Saved us $17,656 on metal alone"

Yes, simply by changing stamping methods, this NILSON Customer profited 4 ways:

1. Production increased 80%.
2. 72% less metal used (per 4 million pieces).
3. Greatly improved quality with minimum of rejects.
4. Strengthened competitive position with greater profit margin.

You, too, can enjoy these advantages in producing your own wire forms and small metal stampings. Parts such as illustrated in the margin were straightened, fed, pierced, blanked, swaged, stamped or coined, cut-off and formed AUTOMATICALLY in NILSON 4 SLIDES in one quick precise operation. *ONE* Machine. *ONE* Operator.

NILSON 4 SLIDES available in wide range of sizes: forming Wire up to ½" diam. in feeds to 32" max. and Metal Ribbon stock up to 3½" wide. Press sections 5 to 30 ton capacity. Heavy Duty Types in 50 and 75 ton models.



MODEL S-3-F Nilson 4 Slide with No. 51B Nilson Tilting Stock Reel.

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Write, Wire, Phone for full particulars.

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Automatic Chain-Making Machines • Automatic Staple Forming Machines • Wire and Strip Reels • Feed Presses • Wire Straightening Equipment • Slide Feeds for Presses

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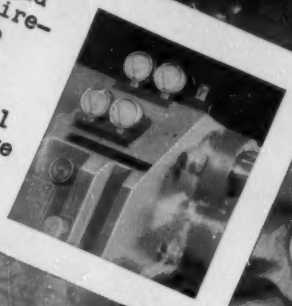
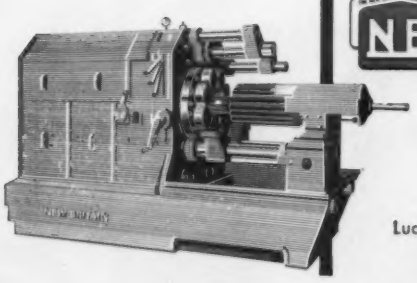
We'll answer within twenty-four hours.

This piece with rigid concentricity requirements could only be machined by using reduced chucking pressures in the final stations...an exclusive feature of New Britain Automatic Chuckers.



Our general catalog is filed in the Sweet's Machine Tool Catalog File.



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NEW BRITAIN *Automatics*

Machines high-precision bearing races in 30 to 60 seconds

with TIMKEN® bearings on the spindle

THIS Acme-Gridley CHUCK-MATIC machines the races of high-precision bearings from 4" to 8" in diameter. And it does it in 30 to 60 seconds, operating at speeds and feeds as fast as carbide tools can take. The spindle bearings must have high precision. And must keep that precision at high speeds, under heavy combination loads. That's why National Acme specified Timken® precision bearings for the spindle.

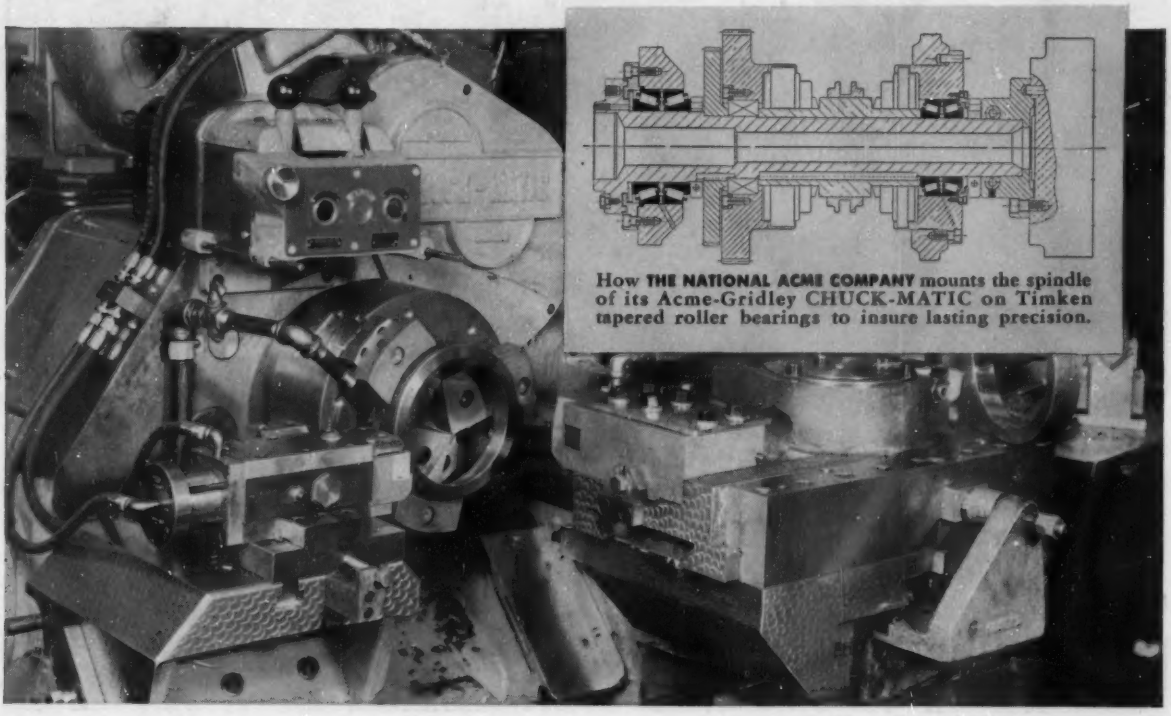
The tapered design of Timken bearings lets them take radial and thrust loads in any combination. The spindle is held in rigid alignment. End play is eliminated. These factors plus the extreme accuracy of Timken bearings assure precision machining at all times.

Full line contact between the rollers and races of Timken bearings gives them extra capacity to carry the loads of the heavy, high-speed cuts. And since Timken bearings on the spindle normally last the life of the CHUCK-MATIC itself, maintenance is reduced.

Power is saved in the CHUCK-MATIC because Timken bearings practically eliminate friction. They are geometrically designed to give true rolling motion and they are precision manufactured to live up to their design. And to get the quality of steel to meet our exacting specifications, we make our own. No other U. S. bearing manufacturer takes this extra quality control.

Specify Timken bearings for the machinery you build or buy. Always look for the trade-mark "Timken" on every bearing. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.



How **THE NATIONAL ACME COMPANY** mounts the spindle of its Acme-Gridley CHUCK-MATIC on Timken tapered roller bearings to insure lasting precision.

MAGNIFYING GLASS INSPECTION OF EVERY ROLLER!

Every one of the over one billion Timken bearing rollers produced every year is inspected with powerful magnifying glasses to detect surface flaws. It's just one example of how the Timken Company insures uniform high quality.

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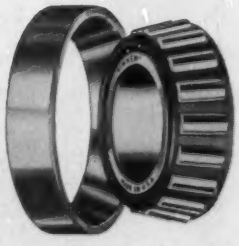
TAPERED ROLLER BEARINGS



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